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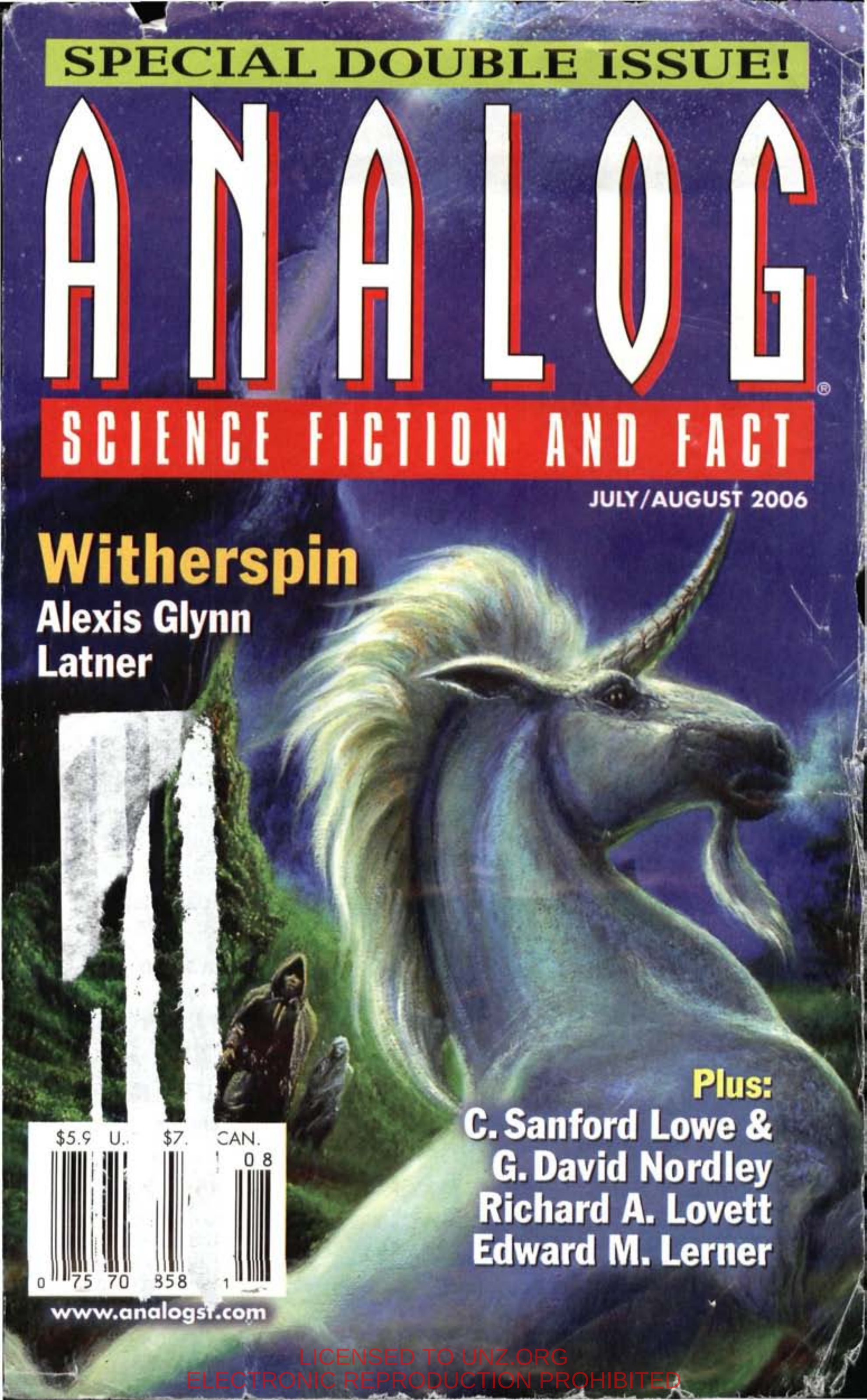

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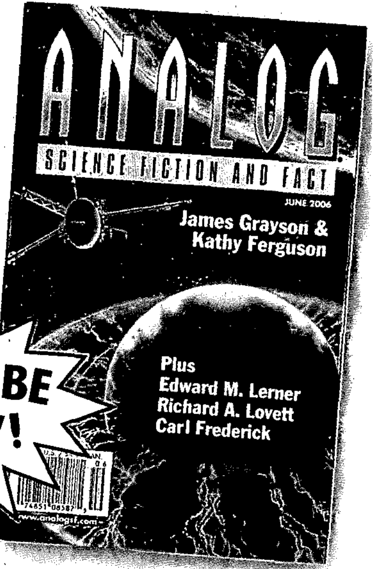
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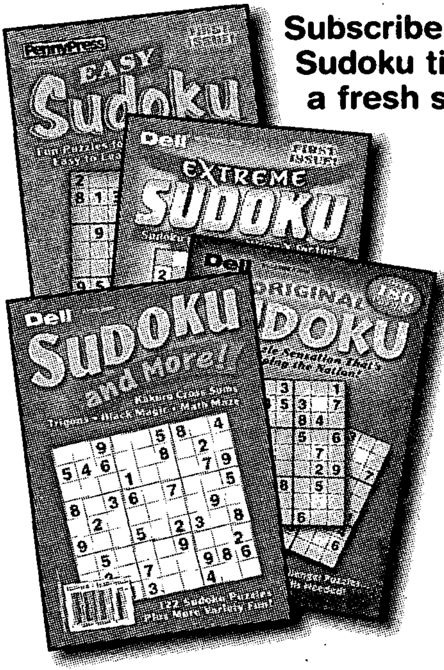
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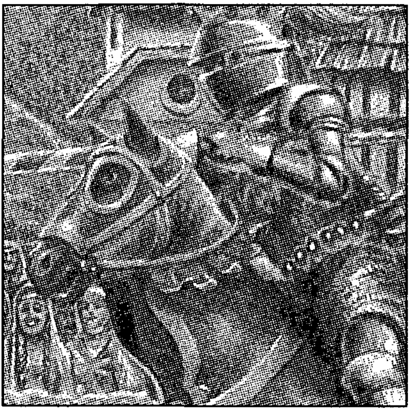

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WHEAT AND CHAFF

One of the most useful things about history is its way of putting present problems and propensities into perspective. Consider, for example, Sir Isaac Newton, the seventeenth-century English scientist and mathematician widely (and with good reason) considered the most important person in the entire history of science. His most significant work was summed up in his book usually known by the abbreviated title *Principia Mathematica* and described by Isaac Asimov (and many others) as "the greatest scientific work ever written."

Just what a landmark it was is hard for a modern person to fully appreciate, if only because so much of what it says now seems so simple and obvious to even a beginning student of physics and is taken for granted in virtually all everyday scientific work. At the time, though, none of it was obvious and hardly anyone else had come at all close to codifying so much so concisely. What we now see as its simplicity was its greatest virtue; nobody previously had realized it *could* be summarized so succinctly. Part of it was the precise, detailed description of the way *everything* moved and responded to forces in three brief, simple laws (two of which, in today's notation, are further consolidated into a single short equation), and in particular how things fell under the influence of gravity. Not just mundane objects on Earth, either; perhaps Newton's greatest intuitive leap was the realization that gravity acts in exactly the same way between any two celestial bodies as it does between, say, an apple and the Earth.

Almost incidentally, as part of the process of working these things out and confirming that they agreed precisely with all the observations available to Newton, he invented calculus—one of the most powerful and elegant of all mathematical tools, and still the everyday language of many fields, not only in the physical sciences but in some areas of biology and even economics. He also did groundbreaking work, eventually published in a separate thesis, *Opticks*, on the nature of light, including the discovery that white light is a mixture of such colors as red, yellow, and violet, and the invention of a telescope using a mirror instead of a lens to avoid the chromatic aberration that had plagued earlier scopes.

Do all of these monumental accomplishments mean that Newton should be revered as a scientific saint and whatever he said taken as the last word on the matters whereof he spake? Of course not. A person with the benefit of the ensuing centuries of research by others—the last century in particular—might reasonably say that Newton's theories contained "gaps," though Newton and his contemporaries could hardly have known about them. His laws of motion, for example, describe reality less and less accurately as you examine smaller and smaller or faster and faster objects. When they're small enough and/or fast enough, you need relativity and/or quantum mechanics—but nobody in Newton's time had ways of seeing objects that small or that fast.

His optics was based on a particle model of light, and we now know that some phenomena are much better explained with a wave model—in fact, the models generally used now incorporate *both* wavelike and particle-like aspects. The gaps in Newton's optics were more serious than those in his mechanics, because optical phenomena not explainable by his particle model *were* already known in his time. Francesco Grimaldi had observed diffraction, albeit rather crudely; Newton chose to ignore it because the effect was small (because of light's small wavelengths, we now say) and inconvenient. And Erasmus Bartholin had observed birefringence, or double refraction, but couldn't explain it with either particles or waves (because wave theory was not sufficiently developed at the time). So even during Newton's life, people (including him) knew that his optical theory didn't fully explain everything. But for a considerable time, though some scientists still pushed a wave model, most rode the Newtonian optics bandwagon, apparently in large part because his mechanics was so robust that many found it hard to dispute his other ideas—a likely instance of "treating him as a saint" delaying further progress in one field.

But his incomplete optics was by no means the least "saintly" of Newton's intellectual endeavors. Most of us have read that he "dabbled in alchemy," but he did far more than dabble. Particularly in his later years, he devoted a *lot* of time and effort to experimentation, none of it successful, aimed at things like transmuting lead into gold. He wrote, as Isaac Asimov put it, "half a million worthless words on chemistry." He was also deeply religious (albeit in some ways heretical, secretly rejecting some key tenets of his church that would have got him in serious trouble had he done so publicly) and wrote even more theological speculation about the possible meanings of obscure biblical passages. He was a "young-Earth creationist" and did his own calculation of the day of creation, coming up with a figure of about 3500 BC.

Should we accept that date, or accept his pure-particle model of light, because such a great scientist believed them? Not at all; the extreme power and usefulness of his mechanical theories do not in any way validate any other ideas he may have had that were less powerful, less useful, or just plain wrong. Should we reject his mechanics because they were put forth by someone who spent a lot of time and energy on "the occult"? Not at all; his belief in some kinds of nonsense in no way invalidates the ideas he produced that were by far the best anyone had conceived up to his time and that still stand up to extensive testing and scrutiny today. (And Newtonian mechanics does just that. The discoveries

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that led Albert Einstein to develop relativity did not prove Newtonian mechanics was all wrong and had to be scrapped, but only that it didn't cover all possible situations and needed to be expanded and generalized. Relativity becomes indistinguishable from Newtonian mechanics under a wide range of everyday and not-so-everyday experience, and Newton's mechanics can now be viewed as a special limiting case of Einstein's.)

Each idea must be judged on its own merits, and not on the personalities or reputations of the people who propound or embrace it. Just as the same plant produces both valuable wheat and inedible chaff, a single person quite often does or believes some things that are real and true and valuable, and others that go nowhere and may even be outright nonsense. And just as with wheat, a sensible person does not discard the whole plant, but welcomes and uses the wheat while discarding the chaff—not maliciously, but just because it isn't nutritious. Doing that, of course, requires learning to tell the difference—which, in the case of ideas, means learning to judge which ones actually enable us to better understand the universe or live better lives, and which ones don't.

The difference is not always as clear-cut and obvious as we might like. Some ideas are of limited value but can serve useful purposes until someone develops more refined ones. Some that don't pan out are not clearly bad at the time, but simply turn out not to go where their pursuer hoped they would. In Newton's case, his mechanics was and remains of great value, even though later experiments found gaps where it needed to be expanded. His optics was good enough to be useful for solving certain kinds of problems with high accuracy, though even he knew that it could do nothing for others. If pressed, he might well have acknowledged that it would probably be eventually replaced by something that could handle both kinds of problems.

His alchemy could well be viewed as serious scientific efforts to lay the groundwork for chemistry, but the breakthroughs necessary to make a real science of it would have to wait for others to make them. However well-intentioned his efforts in this area may have been, in terms of results, they went nowhere of lasting value. And his efforts to calculate the date of creation had

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nothing to do with science, proceeding instead from the assumption, so relentlessly drilled into practically everyone then that hardly anyone would have thought or dared to question it, that everything the Bible said *had* to be literally true.

Newton, of course, is merely one example; the principle applies to practically everyone and everything, in science or other endeavors. Nikola Tesla made enormous contributions to the understanding and application of electromagnetism; the whole huge power grid on which practically everything in our civilization now depends rests upon them. But late in life he went off on what sounded like wild tangents, making bizarre and unsubstantiated claims that led many to assume he had gone "off the deep end." Some of those claims still lie untested in his notebooks, and among them may be more valuable contributions; but we can't assume that because of his earlier accomplishments. Nor can we rule out the possibility; but even if the later stuff is all purest nonsense, it detracts nothing from those earlier achievements.

Albert Einstein did more than anyone for several centuries to revolutionize physics, but was unable to accept some of the ideas that still later physicists found it necessary to develop. His rejection of those ideas, despite his stature, did not invalidate them.

One of the first things I learned as an editor, reading all the manuscripts that came to a magazine, was that hardly any writer is always at the top of his or her form. Some are more consistent than others, but many have produced both duds and masterpieces. The masterpieces don't redeem the duds, and the duds do not diminish the masterpieces.

Anyone who chooses to read all this as an allegory for our times is welcome to do so, but my essential point is quite simple and widely applicable: ideas—*any* ideas—can be meaningfully judged only by their own merit. And that is determined by how well they stand up to testing, how well they improve our understanding and our lives—not by who first said them, who accepts them, or where they are written. ■

My political ideal is democracy. Everyone should be respected as an individual but no one idolized.

—Albert Einstein

Everyone thinks of changing the world but no one thinks of changing himself.

—Leo Tolstoy

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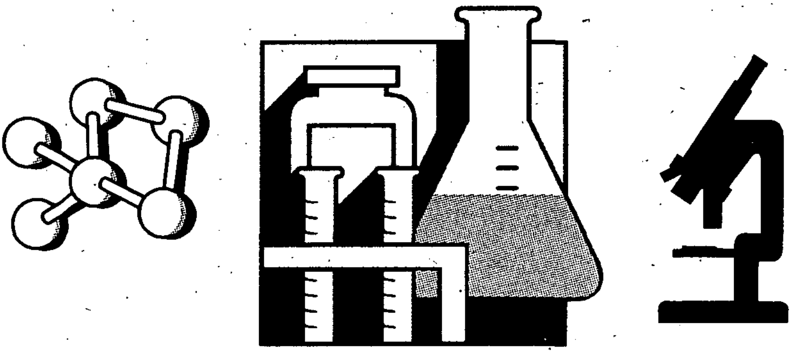

Thanks again to everyone who voted in our annual poll on last year's issues. Your votes help your favorite writers and artists by rewarding them directly and concretely for outstanding work. They help you by giving us a better feel for what you like and don't like—which helps us know what to give you in the future.

We have five categories: novellas, novelettes, short stories, fact articles, and covers. In each category, we asked you to list your three favorite items, in descending order of preference. Each first place vote counts as three points, second place two, and third place one. The total number of points for each item is divided by the maximum it could have received (if everyone had ranked it 1) and multiplied by 10. The result is the score listed below, on a scale of 0 (nobody voted for it) to 10 (everybody ranked it first). In practice, scores run lower in categories with many entries than in those with only a few. For comparison, the number in parentheses at the head of each category is the score every item would have received had all been equally popular.

NOVELLAS (2.86)

1. "Sanctuary," Michael A. Burstein (3.93)
2. "The Diversification of Its Fancy," John Barnes (3.03)
3. "A Few Good Men," Richard A. Lovett (2.96)
4. "Chandra's Pup," Bud Sparhawk (2.70)
5. "Audubon in Atlantis," Harry Turtledove (2.51)

NOVELETTES (0.87)

1. "NetPuppets," Richard A. Lovett & Mark Niemann-Ross (2.15)
2. "Mars Opposition," David Brin (2.08)
3. (tie) "In the Loop," Brian Plante (1.22)
   "Of Kings, Queens, and Angels," Rajnar Vajra (1.22)
   "Do Neanderthals Know?," Robert J. Howe (1.22)

SHORT STORIES (0.57)

1. "Alphabet Angels," Ekaterina Sedia & David Bartell (1.79)
2. "The Inn at Mount Either," James Van Pelt (1.58)
3. "Letters of Transit," Brian Plante (1.43)
4. "Prayer for a Dead Paramecium," Carl Frederick (1.32)
5. "A Christmas in Amber," Scott William Carter (1.14)

FACT ARTICLES (2.00)

1. "Mission to Utah: A Science Fiction Writer's Adventures at the Mars Society Desert Research Station," Wil McCarthy (4.26)
2. "The Prehistory of Global Climate Change," Richard A. Lovett (2.89)
3. "Big Brother Inc.: Surveillance, Security, and the US Citizen," Laura M. Kelley (2.25)
4. "Gene Doping and Other Olympic Scandals of the (Not-So-Distant) Future," Richard A. Lovett (1.97)
5. "Where Are They?," Thomas Donaldson (1.85)

COVER (2.00)

1. November (for *Sun of Suns*), by George Krauter (3.63)
2. May (for "Footsteps"), by Vincent Di Fate (2.91)
3. January/February (for *The Stonehenge Gate*), by Vincent Di Fate (2.62)
4. October, by Dominic Harmon (2.57)
5. July/August (for "Of Kings, Queens, and Angels"), by Bob Eggleton (1.6)

This year fact articles had a conspicuously strong winner; covers, short stories, and novellas had clear winners but not landslides—but the first-place in short stories is a notably strong showing by a new pair of collaborators. Novelettes showed some very tight competition, with a very close race for first and a three-way tie for second.

The number of votes was pretty good, but since AnLab votes are so useful to everyone concerned, we hope to get even more next time. Use e-mail or "snail mail," whichever you prefer, but please vote! (Please be careful to vote in the right category, as listed in the annual Index. Sometimes a few votes are wasted by being cast in the wrong category, and those simply can't be counted. If you didn't use the online voting on our website [www.analogsf.com] this year, you might want to try it next time; it makes that problem virtually impossible!)

Virginia Brekhus, of Valrico, FL, is this year's winner of a free one-year subscription in a random drawing from all ballots received. Next year that could be you—and the more votes we have, the more the results mean!

Witherspin

Alexis Glynn Latner

Human beings excel at creating complications—both in their surroundings and in themselves.

Wendis was a realm of wind, always, and frequent fog, and at aphelion, the wind and fog were cold. Nia Courant was glad to be wearing a supple but warm field jacket today. Martan seemed content with only a thin windjacket, wrapped in grim memory and oblivious to the chilly weather.

The cool air smelled of wet rock and pine needles. Their breath condensed into visible wisps. The trail twisted around a flat boulder where a gorge dropped below the path. On the far side of the gorge a waterfall leaped from a rocky rim high above the overlook to a foamy pool far below.

The water's path slanted. It looked like a vast crystalline scarf trailing behind the incessant rotation of Wendis. "Canting Fall—the highest waterfall in the Wend Range," said Nia.

Martan didn't quite smile, but the lines of his face relaxed. "You were right. This is beautiful."

"And peaceful, and private, and you promised to tell me about your enhanced abilities." Nia seated herself on the flat boulder. "Start with just one?"

"If you insist." Martan sat beside her, depositing the knapsack that contained their lunch. "The university is there." He pointed up into the fog. "Seventy degrees spinwise."

"How do you know?"

"I excel at situational geometry—the relative geometry of everything around me—including closing distances."

"That would have been useful in your previous life."

"With you, I'd like to forget my past," he said quietly.

Damn. She'd invited him to the Canting Fall Overlook to demonstrate trust in him, in the hope that he would open up to her. Instead *she* was feeling trust. And a great deal of attraction. He sensed it. He reached toward her face.

"No!" She drew back. "I know about that one!"

He looked stung. "You don't understand it. Yes, I am wired for artificial telepathy through the neo-nerves in my fingers. But I never use it except when I need it."

"Like three weeks ago?"

"That was an accident. I didn't mean to—" he faltered.

Invade my mind. Find out the most painful secret of my life. Derail our romance. Shocked indignation washed over her again, and it still had an undertow of fright.

"I didn't think. It was a—a kind of reflex." He made an odd, one-shouldered shrug.

"Don't touch me," said Nia.

"It's not like hearing, always sensitive." He jammed his hands into the pockets of his windjacket. "It's not a sixth sense at all. My telepathy stays off until I turn it on."

"Does it work only through your fingers?"

"Just through the tips of my fingers, I swear."

"All right. Don't put your fingertips on my skin."

Martan's shoulders drooped, but he nodded. His acceptance of Nia's resolve encouraged her. She put her hand on his upper arm, feeling the contours of supple muscles under the thin jacket. "See, I'm not asking for a total embargo on touch."

His lips quirked.

Come on, smile. She had seen him truly smile only once before, but it had been as dazzling as the end of an eclipse.

A grating warble broke the silence. Martan tensed. A dark winged shape flitted in the fog above them.

"Condor," Nia said.

"No. It has a crested red head. That's a Faxen bird." He snatched up the knapsack. "It's a carrion eater, but in the early colony days on Faxe they called it the deathbird. The species is intelligent enough to *create* carrion. We better get away from these trail drop-offs."

Martan moved with the fluid coordination of an athlete, or a predator, on the steep trail as it zigzagged down from the edge of the gorge. With much less grace than Martan, the Faxen scavenger loosely flopped in the air above them. Martan scowled. "Unpleasant species, and in no danger of extinction on Faxe. Why in God's name would they have it in a park?"

"For one thing, this is not really a park, except for the part of it called Haven. For another thing, it's not really under anyone's control. You don't believe me," Nia observed.

"Hah! Everyone on a dozen worlds has heard the hype about finding danger, adventure, and romance here. Pick a theme, pick a dream, wend your way, play a game, win or lose the prize of your life, in the Magic Mountains!"

"Saying Magic Mountains makes you sound like a tourist. To insiders, it's the Wend Range, or the Wends, or the Strange Range."

He frowned. "In my travels I saw the Rings of Ruin, the blue star of Goya's Sea, and the Lights of Vere—and other beautiful and terrible things. I'm not very interested in an amusing park for tourists. Or what to call it."

"It's not always amusing. Since portable communications devices are forbidden, visitors have to handle anything that goes wrong on their own, unless they can find a park ranger," Nia said. "Haven is the lowest sector, not really a zone, because access is uncontrolled and the park rangers are easy to find. All of the zones have some degree of real danger, and more danger the higher you go in the zone numbers. This is Zone Four, and we could slip and break a leg. Or the Faxen bird could dive at us and try to knock us off the edge of a cliff, if that's what its instincts are."

"Hah. They just allow a little risk to pique the interest of jaded interstellar travelers."

Nia counted six separate misconceptions in what he was saying. Unfortunately, he wasn't the type to argue constructively. He'd stonewall. "All right, it's a park—like Zaber, Specter, and Chance are mountains." Invisible in fog, Specter's unnatural peak loomed above them.

Point taken, he clamped his mouth shut.

When they came to a log serving as a footbridge over a cold, turbulent stream, he extended his arm to her. As soon as she stepped onto the log, she felt perilously off-balance. Slipping off!—her planet-born reflexes shrieked. She clutched Martan's arm. For people who hadn't been born in spingravity, Coriolis effect was the poltergeist of Wendis—invisible, unpredictable, and sometimes destructive.

Steadying Nia, Martan walked over the log slowly, precisely, and backwards.

"Superb coordination in spingravity must be another ability of yours," Nia muttered when her feet rested on level ground again and her heart stopped tripping.

"Yes," he said with a half-smile. He tended to smile and gesture in an odd, one-sided way. Not always the same side. It was as though part of his soul smiled and another part stayed secret.

With a cascade of wingbeats, a small gray bird fluttered out of the fog, alighting on a rock by the stream. It bobbed its whole body up and down several times. Then it strolled out into the swift stream, submerging itself further with each unruffled step until the crown of its head disappeared under the icewater.

"What was that?" Martan asked.

Nia checked the Magic Mountains Guidebook. "It's called an ouzel. That's a species from Old Earth."

"Some of the amusing oddities here are authentic?"

"Most of them are." Nia touched the guidebook's access button. Its floppy pages reconfigured into a pocketable square the size and texture of a folded handkerchief. She put it back in her jacket's breast pocket.

The trail led to a lawnlike meadow that cradled a frosty pool. Canting Fall's waters slanted into the pool with far less commotion than an equally high waterfall planetside. That was just as well, since cold spray would not have been pleasant in weather this chilly.

"Good place for a picnic." Martan raised an eyebrow. "Can we just enjoy it while we eat—no questions asked?"

The Engineers' Guild maintained the world and gave it Earthlike seasons by varying the flux of heat and light. When Wendis neared aphelion in orbit around its star, the engineers caused it to have winter, and the weather was more stable than in any other season, clear and bright, reminding Nia of her home planet, Azure. She had packed an Azure-type lunch of synthmeat sandwiches and hot kavva. She let herself fantasize that she had a less complicated life, on a terraformed world with normal gravity, with an uncomplicated male companion. After lunch, Martan stretched out on his back on the dry, cool grass, near the empty knapsack. Nia sat cross-legged beside him.

The Canting Fall fell slower than the eye insisted it should, and twisted as it went. From this close, it looked like sculpted crystal. It reminded Nia how perplexing her existence really was. Martan attracted her very much, but he had been a killer—not born, but made. But he had repented of it. But he could read her mind with a touch, if he wanted to. But he needed her.

But he was what he had been.

She kept her consternation to herself.

Through a rift in the clouds, light from the sunspar flooded the meadow. The traveling sunball was just west of midspar. A bank of rhododendrons shielded the meadow from the cold spinwinds. Nia felt warm enough to unfasten her jacket. Deliberately keeping her tone light, she said, "Wildway is the part of the Wends most like wilderness on Earth."

He gave her his one-sided smile. "Until you look up and see the foothills on the far side, with the university's towers and the hospital dome."

She'd seen those sights from Wildway on clearer days, but she'd never seen anything like him. He had medium brown skin and dark brown hair, and eyes so dark that the irises looked black, even in sunsparlight. Could that be evidence of his visual enhancement?

Martan's gaze met hers. "When I was little, I never imagined a woman like you."

At some point, soon, she'd ask him where he had been a little boy—presumably in the Faxen Union, on one of the five partly terraformed, incompletely civilized worlds under the dominion of imperious Faxe. "What do you mean?"

"Your blue eyes and silver hair. I didn't meet any Azureans until after I left home."

Azure was a half-terraformed but quite civilized world, not a part of the Faxen Union, but in close enough proximity to the Union to be acutely aware of Faxe's power and politics. "Even here in Wendis, lode-silver hair is far from rare," Nia pointed out.

"Huh. Next year the trend-following young people of Wendis will change their hair to a different color. But yours is real." Reaching up, he touched a long stray curl. "I can tell by the way the strands catch the light." He twined her hair around his finger.

The slyly possessive gesture shot a thrill through Nia. *Damn!* Aside from (surely not because of . . . ?) his scary past and special abilities that included telepathy, he fascinated her. She should remain aloof until she better understood him. But she would be warmer in his arms. She let his arm slide under her jacket. He obediently kept his hands on the fabric of her shirt as he pulled her into a close embrace.

Then he jerked away. "Something in your pocket moved!"

A green tendril dangled out from under the flap of one of the main pockets of her field jacket. Unfastening the pocket, Nia lifted out an untidy little bundle of leaves and tendrils. "What are you doing in there?" she asked it sternly.

Martan sat back. "What *is* a plant doing in your pocket?"

"It's a hugwort—an alien species they recently discovered at the xenobiology field station on Jumala." She placed the hugwort on her knee. It balanced there like a small, potless and badly misplaced houseplant.

Martan leaned closer. "No roots?"

"It has a single root, of a sort. See? In the middle of the leaves, here, what looks like a tuber but it feels like a mouse, fuzzy and warm."

The hugwort wriggled out of Nia's grasp to scramble down her leg and onto the grass. Both of Martan's eyebrows went up.

"They're mobile. And incredibly cute. Even Professor Zeng's official write-up lapsed into phrases like 'enchanted morning glory.' He gave me one because I'll need to design some legal protection for them, to save the species from poachers and the illegal pet trade."

"Can you design legal protection for *me*?" Martan said suddenly.

Nia was surprised and pleased, and careful not to let it show. She said levelly, "Yes, though you're a stranger legal case than it is."

"I am not stranger than an enchanted morning glory!" Martan said with offended dignity.

"But it never killed anyone," Nia said.

A shadow flopped in front of the sunspar. Martan cursed it under his breath.

"There are plenty of Faxen flora and fauna in the Wend Range," said Nia. "They thrive in the same conditions as Earth creatures. Faxe was the new Earth—the Promised Land on the other side of the stars—when it was first colonized. Too bad it's become a police state."

"I of all people know that. I was the sharpest tool of the state against its enemies. In the end, I defected." Nia knew that part of his story, though only from a dry medical report. He had defected to Wendis under the cover of a fiery explosion. It had taken the Wendisan doctors months to heal him, while they catalogued all the physiological features that made him what he was. "The price I paid to defect was that I almost died. Does that count for something?"

"Yes, it does." To define exactly how much it counted for would take the best work of her whole career in interstellar law. To win Martan the legal freedom to leave Wendis without fear of arrest and deportation to Faxe would take better work than she had ever done before. It would vault her into the elite circle of those who shaped interstellar law. She was unsure how she felt about Martan—her feelings were a highly charged muddle—but she was crystal clear about what she wanted from him right now: information about himself. "Was there a formal word for the kind of operative you were?"

He laughed humorlessly. "Not among insiders. A hellhound is a hellhound."

Well! That was the first time he'd voluntarily uttered the word to her.

The hugwort ambled toward the bank of rhododendrons. It wouldn't get lost; it had a talent for exploring new places and finding its way back. Smuggling itself in its owner's pocket for an outing was a new trick, but Nia was glad it had done so. The hugwort had somehow cracked Martan's reticence to talk about himself.

Hellhound. People across a dozen worlds and particularly those in the lonely way stations between the worlds had heard of Faxe's hellhounds. Very few people had knowingly looked a hellhound in the eye and lived, and she was one of them . . . . A shiver went down Nia's back. She made sure not to let it chill her voice. "Please tell me what hellhounds can do. It doesn't have to be personal, you. Just say what your kind can do, if it's easier for you."

"It's not. We were brain-trained to give nothing away."

"Brain-trained?"

"Juvenated and then retrained in thinking—and feeling. The doctors in the University Hospital believe they undid the dehumanizing parts of the brain-training, while they were putting me back together. They couldn't give me back the memories that were stripped away in the juvenation, but they think I can learn to be human again. Is it really unthinkable for us to start again where we stopped three weeks ago?"

Caught off guard—still processing the implications of what he'd told her about brain-training—she said, "I'm a university lawyer, advising the university on what to do with you, since you're in its employ. The ethical aspect of having a relationship with you is not a problem."

"Ethical aspects don't matter to me."

"*That* is a problem!" she retorted.

"Then help me understand ethics—or law—the way you see it. Give me a second chance with you. I—"

A green streak darted out of the bushes. It scurried toward Nia. Climbing up her jacket to its pocket, it stuffed itself in, and managed to fasten the button with a tendril, which it then retracted within the pocket.

"What kind of intelligence do they have?" Martan asked.

"No one knows. I've never seen it do anything like that."

He looked at the rhododendrons from which the hugwort had emerged so suddenly. His spine went stiff. "Get up. Are there real predators here?"

Nia pulled out the guidebook, which unfolded itself back to the natural history pages. She scanned the list under Animals, Biological.

"There's a big animal behind those

bushes. Is it a trick?"

"This says Wildway harbors a few mountain lions. Young male lions may become aggressive. If you encounter one, just move away slowly."

He shoved her toward the open end of the meadow, away from the bushes. She was still reading the guidebook. "But that's only in spring, not winter. I don't see where—"

"The deathbird is circling overhead."

"You hate it because it reminds you of Faxe?"

"It's too focused!" he hissed.

"Things in the Wends can go wrong," Nia said slowly, "what the insiders call witherspin. It's never happened around me, but I know what to do." She flipped to the orange section of the guidebook. When she touched the schematic map for their location, a bright series of arrows appeared on the map. "We're in Zone Four right now. From any zone, you can always reach Haven. The door to Haven is that way."

He herded her along, looking back over his shoulder.

"Around these little trees—there—it's in that cave."

Martan stopped short. "Not good. No way out."

"Look at the back of the cave. Those numbers mark two gates to higher zones, but the bright orange door leads to Haven, and it'll open as soon as we touch the doorplate. Come on." She went to the orange door and demonstrated.

Nothing happened.

"It's not working right?" she said unbelievingly.

Martan cocked his head. "Something heavy is moving. I hear dead leaves crackling."

"I don't hear anyth—"

"I do! Can we use the gates?" he demanded.

"The zone gates don't let visitors change zones without permits, but I have a university authority key." Nia whipped the small cylinder out and inserted it into the Haven door's keyhole. Again nothing happened.

"It is stalking nearer."

She wasn't sure she believed him. But something had given the hugwort the scare of its little life. Something was wrong with Haven's failsafe door.

A concave part of the cave's rocky back wall displayed 5. A convex part of the wall said 9. Nia inserted the key in the unobtrusive slot under 5.

The concave wall rotated, taking them with it.

Harsh daylight flooded their eyes.

"Desert—cliffs?" Martan sounded incredulous. "The other place was—"

"Valleys full of fog and mist and soft green plants." Nia crossed her arms. "This one is sand and glare and spiny plants that bleed when you break them. Some things here shock you if you touch them. We're in the Wendway called Inferno. The fauna and flora are from the most hostile alien world ever colonized by humanity."

To one side, the land fell away. They were on the knees of Mount Zaber, close—too close for comfort—to the precipitous canyon between Zaber and Specter.

"Valles Avendis," said Nia.

Martan's gaze jerked up. Deeply scored, reddish rocks climbed the steep flank of Zaber. Far above and east of their zenith, Specter's summit was swathed in clouds. The sunspar ran straight through the clouds, but the brilliant sunball had traveled well west of Specter. It was mid-afternoon in Wendis.

Behind the sunspar, the foothills of the Wend Range were swaddled in fog and hung overhead like a barrel-vault. From here they couldn't see the university, much less the rest of Wendis, not the city to the west, or the farms to the east, or the shallow green bowl of the Celadon Sea. It was as though they had stepped out onto a hostile alien world.

"Incredible," said Martan.

"Welcome to the Wend Range. The

way the gate system is designed, most animals and plants can't move from zone to zone. People shouldn't. It's disorienting in the extreme," said Nia. Then she heard a coarse rasping sound. The zone gate was revolving back around.

"Come with me," said Martan. He took her wrist in an unbreakable grip and scrambled, pulling her along, up the precipitous slope.

"Stop! What are you doing?"

"Finding cover and a vantage point to watch the gate."

His strength startled her. She had to climb with him or be dragged along. Fright flared in the back of Nia's mind. If she struggled and broke free of him she might fall—and it was a long way down to the bottom of Valles Avendis. "Don't believe the hype," she pleaded. "Bad things seldom happen to ordinary tourists. Not unprovoked predator attacks!"

He hauled her up alongside himself on a shelf of rock and said vehemently into her ear, "I was predator and prey for seven years. I know unhealthy attention when I feel it." Finding a niche in the cliffs screened by a spiny plant with shiny purple leaves, he slithered in and pulled her in after him.

"Don't touch the leaves!"

"I won't. You needn't. Look." He pointed below them, where a black bird raggedly circled in midair. "That is the same deathbird, and now it's here."

Nia had often seen gulls ride the winds beside the chilly new seas of Azure. Here in Wendis, with nothing but spingravity—a counterfeit of planetary gravity—some birds managed a counterfeit of flight that typically looked comical. But now she found the deathbird's flight disturbing to watch. Its head turned from side to side as if scanning the harsh landscape. For the first time, she felt afraid of it. "Birds sometimes flutter-fly over the barriers," she murmured. "Of all things in here, the birds are the most free—they fend for themselves although their nests are protected."

"*Their* young are poisonous."

"You're being paranoid," she whispered. "There's no reason for things to go witherspin because we're here. As far as anyone in Wendis knows, you're just an academic."

"Faxe sends revenge a long way," he said under his breath.

"Here?"

"Our handlers never sent us in here."

"Of course not. The insiders in the Wends don't want anybody else's games going on." She rubbed a bruised knee. "And the price of sabotaging normal operations in the Wends, to make an outsider have an accident, is so steep that it's almost hypothetical."

His glance flickered to her. "Hypothetically, how would it work?"

"An enormous sum of money would come from Outside. Things would go witherspin. Rangers distracted, busy elsewhere. No tourists around—" She gulped. Even for winter in the Wends, it was strange how few other visitors they'd seen today. She made herself finish the thought. "Whoever it is who has rich, remorseless enemies is fatally injured or simply disappears. Anyone who's arrested was an unwitting pawn, the legal system turns into a house of mirrors, and charges are never brought."

"I have enemies. All the followers and kin of every enemy of the state I executed. And the Faxen secret intelligence agency, since I defected."

She shook her head impatiently. "What lives in the Wends is extremely dangerous too, and cares nothing about the politics of colonized planets."

"That's ridicu—" His face hardened. Far below them, the gate was turning again. A huge, tawny cat with fangs as long as its head stepped out.

Nia clutched Martan's arm. "That's Old Scratch! The sabertooth tiger from The Most Dangerous Game in Zone Nine! It's a robot programmed to be a savage predator—"

"Robots can be hijacked," he grated. "Deathbirds can be trained."

Nia's heart pounded. "We've got to get to Haven."

"Give me that book." He scanned a page and frowned. "This makes no sense. It looks like we have to go uphill to find a door to Haven. But higher zones are more dangerous."

"Don't confuse uphill with upzone! Almost every zone has an incredibly irregular border that somehow runs all the way from sea to one of the summits—"

"I see. Uphill now, hurry."

Wind blew strands of her hair across Nia's face. She wasn't resisting Martan now, but the rocky slope was rough and increasingly steep. Martan caught her when she tripped. "This is enough less than full Wendis spin-gee to botch my coordination," she admitted bitterly.

"I won't let you fall," said Martan.

They came to what looked like a rockslide, a field of rocky debris. Martan started to pick a way through. He froze as a gaunt, ugly, dog-like creature sprang out of a crevice in the rubble and confronted them, growling.

"Infernal jackal!" Nia whispered.

Stepping forward, Martan flung his arms out threateningly. He grimaced. His teeth flashed in the hard bright sunlight. The animal snarled back, but it retreated. Martan bounded on up, keeping Nia close to him.

Uphill from the rockslide, Martan scooped up some rocks and stuffed them into the knapsack. "What is an infernal jackal?"

"One of the few terrestrial species that thrived when colonists from Earth introduced them on Inferno. Back there, you—your teeth—" Nia stammered. Martan gazed at her expressionlessly, which unnerved her further. "I thought I saw . . . maybe not."

He shouldered the knapsack, now slightly lumpy with a cargo of rocks. "Not like what the big cat has. But yes, I can morph, in a few small ways."

She hadn't imagined it: Martan had showed the jackal a neat sharp pair of fangs. She felt lightheaded.

"I retracted them right away," Martan said.

Snarling erupted behind them, and a scrabbling sound, and then a yelp, abruptly cut off. Had Old Scratch met the jackal? Nia felt dread ball up unto a sick, cold lump in her stomach.

"Hurry. Uphill." Martan held a large, edgy rock in one hand. But what good would rocks do against the giant cat?

Mount Zaber confronted them with cliffs of deeply folded stone with dark recesses. Nia opened the guidebook. "To keep going upward from here, we would have to zone up."

"But there's a door to Haven, where?"

"That way. The door is inside the mountain."

The deathbird slanted down from the sky to flap in a lopsided circle above them, as if announcing their location. Hardly breaking his stride, Martan hurled his rock at the bird. The rock traced a line so straight it might have been drawn in the air with a ruler. The rock connected with the bird's red head. Trailing purplish blood, the deathbird flailed its wings and tumbled away over Valles Avendis.

"So much for that." Martan sounded satisfied. Taking Nia's arm, he shepherded her into the deep fold in the red cliff. In cold shadow deep inside it, they found the mouth of a tunnel that slanted down into the mountain. Martan slowed them both to a fast walk. "And if this door doesn't work either, like the last one?" he asked conversationally.

Nia was skirting panic like a ball circling the rim of a hoop, but she forced her mind to work logically. "If it doesn't work, we're in the center of a hideous plot, and there'll be a nasty surprise in Six. No. To Seven."

"But that's an even higher zone. Isn't it even more dangerous?"

"Yes. But I've been there before. And they control their own gates."

A single orange arrow illuminated the smooth floor of the tunnel. *This way to Haven.* Nia drew in a deep breath of hope.

Further in and down, and the daylight faded. Finally it seemed completely dark in the tunnel to Nia, but Martan steered her around invisible obstacles, one of which rattled unpleasantly. The passageway took a dogleg turn in an alcove where 6, 7, and 10 shone in the dark. "The Haven door shouldn't be much further," Nia said eagerly, just before her foot splashed into cold water. She recoiled with a gasp.

"Subterranean lake," said Martan.

Nia's hands shook as she opened the guidebook, which helpfully self-illuminated. "It does show a lake, but in winter it's supposed to be small—it's not supposed to block the door to Haven except in spring—"

"Put that thing away and be quiet," Martan said in a sharp whisper.

"But—"

He clamped a hand over her mouth and held her still. "I hear the water rising," he said softly. "We can go back outside or we can use the upgates. With Old Scratch out there, outside sounds worse than gating up."

Nia nodded.

"You're shaking. Cold? Scared?"

She nodded. She felt butterflies in her stomach, butterflies with wings of cold lead.

"I can deal with danger," he breathed in her ear, "though I didn't expect it today." He rubbed the back of her neck.

Eager to be calmed, defended, saved, she held on to him tightly.

"Scratch is in the tunnel," Martan said. "Give me your key. Back to the upgates. *now!*"

They made a wild dash in the dark, veering toward the upgate marked 7. When Martan thrust the key into the keyhole, the gate illuminated. Nia saw the huge robot cat loping down the tunnel toward them just before the wall circled around them and sealed them off from Inferno.

Nia shook with relieved tension. The two of them had just backed away from saber-toothed death into a normal translating elevator. The translator had slick sides, grab bars, and bright green footprints glowing on the floor to indicate which side would be down for the ride.

Four of the glowing footprints on the floor were big paws with long claws, and there was a pair of cloven hooves.

Keeping a protective arm around Nia, Martan held onto a grab bar. Coriolis force pushed them both against one wall as the translator descended smoothly in the spingravity of Wendis. The translator then moved sideways-spinwise, and the pseudo-gravity increased slightly

The translator began to slow. "What next?" Martan asked. His tone sounded casual and interested, the tone of *what's for dessert?*

"You'll see." Nia hurriedly smoothed her hair, fastened up her jacket, and brushed the red rock dust of Inferno off them both. "I handle this one."

The door opened to reveal a high-ceilinged room with painted walls and beveled doors. A high desk loomed at the end of the room. Behind the desk sat a figure with flowing robes over a misshapen body and a flowing beard over a misshapen mouth. Martan's eyes widened. Whatever he had imagined his next challenge would be, he wasn't expecting this.

Here goes—something. Nia stepped forward. "May we enter the Fair Country?"

"Go away, Silver," the Gatekeeper answered in a disinterested tone. Behind him, the tallest door in the room, the door to the Fair Country, embellished with jewels, stood firmly shut.

Nia answered, "My Fair name is Canter."

"Do say." The Gatekeeper leafed

through the tome on his desk in front of him, an electronic book designed to look like an antique codex. "Very well. Who is he?"

"This is—" she hesitated. "Night." It would be a good nickname for Martan here, a memorable name that meant nothing. Martan nodded. Following her lead.

"Bring him back in Fair time. Go away now," said the Gatekeeper.

"No. Night is not a tourist. He's a Traveler, and he has political asylum in Wendis."

The Gatekeeper stared at Martan with piercing, mismatched eyes, brown and pale blue. "Very well. Watch your step."

The jeweled door glided open onto a patio decorated with potted citrus trees with glossy leaves. They entered the patio, and the door snapped shut behind them. Nia sighed in relief.

Almost inaudibly, Martan asked, "Why did you tell him?"

"I did not use the h-word, but I did tell the truth, which is the best course of action where the Gatekeeper is concerned. He's an important personage here."

"He looks deformed. Is that a disguise?"

"No." Nia walked to the edge of the patio, overlooking a valley full of tall trees, brown and evergreen. In the heart of the valley nestled a cluster of stone, wood, and glass structures with ridged roofs and numerous weathervanes. She rifled through her memory for everything she knew about the Fair Country, its geography and its perils.

"That village is an attraction for tourists," said Martan. "They don't get killed."

Nia was tall for a woman, taller than most Wendisans, which sometimes made her more conspicuous than she wanted to be, but with Martan her height was an asset: she could look him directly in the eye. "At Fair time, tourists are off limits for the local predators. It isn't Fair time now. But I think you're a match for the locals. Let's go."

A staircase spiraled away from the edge of the patio, coiling down through a hundred feet of thin air to the ground below. Nia gritted her teeth at the sight of it. Planet-born people never completely adapted to spingravity and its Coriolis effect. You'd *think* you were accustomed to it and then you'd take an embarrassing pratfall, especially on stairs and ladders, and the problem was worst in the Strange Range, where the spingravity lessened or increased with higher or lower terrain. A pratfall on the Spiral Stair could be fatal. "You first."

Martan started down the stairs with effortless ease. Nia followed, grimly holding his shoulders to steady herself. Her brain registered subtle discrepancies between how the stairs looked and how they felt, and her planet-born reflexes cried imminent peril. After a few steps Nia gave up and closed her eyes, trusting Martan more than she trusted her own reflexes.

He said, "You did a good job talking us into here. You hold up to danger better than I would have expected."

"Well, you're better tempered in real danger than in a nice park. How wonderful. Some people who enjoy danger join the Star Rangers, others find work as police officers or emergency doctors. You became a hellhound!"

"Hellhound was not a career choice. My whole family died in an anti-Union insurgency. I was in the Faxen Union army and stationed on Goya. My family lived in Delagua on Estrella."

Oh. Delagua, Estrella. An ordinary colony on a half-terraformed world, but it had been near a military base of the Faxen Union where Disunion terrorists detonated a nuclear bomb—an ancient, hideous weapon that left a radioactive scar. Ecologists from the university had established several outposts from which they were calibrating the wound to Estrella's ecology. Nia had never really thought about radioactive wounds in the hearts of Delaguans who'd been away from home at the time. "You were young and bereft, and insane with grief and anger?"

His shoulder twitched. "Something like that."

Illusions that aren't, Nia explained while they went down the Spiral Stair, finding that talking took her mind off the Stair. Word games with high stakes, predators that might take a personal dislike to you. That kind of thing made the Fair Country more dangerous than Inferno. Imagine a festival with all kinds of exciting fake dangers that can become real if they want to.

Martan conceded that the whole zoned park was dangerous. Why did it attract tourists?

Because danger tends to focus people, Nia explained. Facing danger makes people feel alive, and superior to anyone who succumbs to the danger. That was a potent brew of human motivation, and tourists paid well to partake of it, keeping the Wendisan economy afloat.

"There are that many tourists that stupid?"

"Don't tell me *you* never enjoyed trading in danger! You enjoyed Inferno, too."

"I like obstacle courses. The more dangerous the better."

Nia's mental list of his hellhound abilities included supersensitive sight and hearing, exceptional strength and coordination, superior coordination in spingee, and a knack for situational geometry. With skills like that, Nia could imagine a perilous obstacle course being exhilarating. "Whether you realize it yet or not, you're in the right place for you," she told him.

Wendis hadn't always been full of dangerous games. In the beginning, two thousand years ago, it was a magnificent stargoing research habitat with nine sealed ecological zones. Its name had been *Adventus*. But a lot of history happened to *Adventus* since then. During a thousand-year research voyage, better and faster starflight was developed and human colonists radiated across the stars ahead of *Adventus*. When it reached this part of the galaxy, it found a flourishing interstellar civilization of terraformed planets. The huge, worn-out old engines were removed, and it became Avendis, orbiting around a small golden sun, a city-state with a busy starport, university, and the nine-zoned ecological research park

Centuries later, a black asteroid collided with Wendis with disastrous results. It tumbled. The ecological zones were ruptured, many people and animals died, and the port was out of commission for decades, economic ruin following physical disaster. The engineers stabilized the spin, the scientists repaired the park as best they could, and, as one of very few possible ways back to economic health, the city-state remade itself as an interstellar amusement park. Wendis.

These days some people called it Dis for short. Which was a short, handy word—and an ancient synonym for Hell.

If she never descended the Spiral Stair again in three lifetimes, it would be too soon, Nia thought when they finally reached the bottom.

A narrow lane paved with stones led to a cottage set back in trees. It was a well-camouflaged university research station, and her key got them in.

They found an attendant on duty. "Hey, I know you—you're the proctor!" The voice sounded like a university person. But the body was an animated replica of an ancient suit of armor, with a metallic grill for a face under a helmet topped by a fluffy white feather.

"Do I know you?" Martan asked.

"Sure! You come through the High Street pub every night at undergraduate curfew hour. I wear my city shell then, of course."

"The blue racing shell."

The suit of armor nodded, making his feather bob.

Crossing the stars for new worlds had left the human genome rifted with radiation damage. When genetic damage surfaced in a newborn child in Wendis, it was corrected, if possible. The worst cases were implanted in mobile life-supporting mechanisms. Martan had probably seen some baby cyborgs scooting around in the hallways during his own long stay in the University Hospital. Some of the doctors were adult cyborgs themselves. "Why change shells?" Martan asked.

"It's a Fair costume." Nia leaned against the wall with her arms crossed. "An ancient knight."

The feather bobbed agreement. "I'm doing doctoral research in anthropology here."

"And you work as the university's station attendant, right? We need to contact the university," said Nia.

"I'm not supposed to—"

"We have a serious problem, and we need to contact the university!" she snapped.

"But you must be Nia Courant from the University Counsel's Office. I have orders not to send out any messages that might indicate that you're here, but give you a message."

"Then what is it?"

"I wasn't supposed to open it unless I saw you." Tiny lights flashed behind the metal grill under the plumed helmet. "Wow!"

"What?" Nia demanded.

"The University Counsel says you're both in grave danger. And I should give you the latest highway advisory. Lessee—uh-oh! The highway robbers are out today."

"Oh, no," said Nia, feeling a cold shock of fear.

"And—wow! Old Scratch has been trying to get in the Back Gate!" The tiny lights behind the grill sequenced excitedly. "The Counsel says get back to Haven as fast as you can, however you can, and whatever you do, don't get separated. What's going on?"

"It's none of your business."

"Is there going to be an abduction? Can I watch? I could use one for my thesis—"

Taller than the cyborg, Nia stepped close enough to glare down at him and she let anger heat her voice. "You will help us as much as you can, and if you don't, I will file charges of malfeasance in the conduct of university business and violation of the Honor Code, and you'll be lucky to merely be kicked out of the university!"

He stepped back with an audible clank. "You mean this isn't a simulation?"

"No, it is not!" Nia turned on her heel and said to Martan, "Up to the observation deck." That meant climbing a narrow vertical ladder. Martan climbed close behind her to steady her, guiding her shoe to the rung when her foot fumbled in thin air. Damn the spin-gee!

Martan said, "It seems pretty clear that I'm putting you at risk. You should stay here with the cyborg. I'll take care of myself."

She shook her head. "If the Counsel said we're both in danger, she meant it."

"Can't she call in help?"

"No. No one runs the Wends. We're on our own."

They emerged on an observation deck. The hillside rose behind the deck, forested with beech and oak and eucalyptus trees. Tall trees flanked the deck and even grew through holes in the surface, making the deck look like a treehouse. A compact weather station with a whirling wind gauge perched on one of the guard rails.

From here they could see the Highway curving up from the foothills and on through the nearby village. Twilight was settling into the deepest parts of the valley. Soft yellow points of light gleamed in the village. Further uphill, the Highway ran through grassy meadows toward the snowy summit of Zaber. The sunball was on the verge of setting behind the mountain's bulk.

Nia said, "This part of the Fair Country resembles Old Europe, and my looks fit in better here than anywhere else. You look like everybody everywhere. We better not go downhill on the Highway, as tempting as that is. Not with the highway robbers on the move. We can follow the highway up through Davos. That's the real name of the village. Then we'll take the Fair Lane to the tram station and ride the tram down to Haven. At least I hope so. If something goes wrong with that plan, there's the low road. It starts in the village and goes underground. But the low road is dangerous as hell."

"This is a very strange place," said Martan. But he had a slight smile, like somebody looking at a long-loved, much-missed place he'd just returned to. But it wasn't the village he was smiling to see again after long absence, it was the face of danger.

With his head cocked, Martan seemed to be assessing the sounds around them. Nia only heard a few birds, a rustle of wind in the trees, and just at the edge of her hearing, one of the air handlers in the hillside. Martan heard more than that. "Where the lane leaves the Highway there are big animals with metal harnesses, and voices. Men on horses, I think, coming this way."

"The highway robbers! Let's get out of here!"

Instead of going back into the university station, they scrambled down a tree to the ground, then went downhill toward the village, slanting away from the lane and the highway robbers. Fallen leaves, wet and limp, muffled their steps. "We aren't dressed like locals," Nia said. "I hope there are a lot of other visitors in Davos today. Anyway, the only way up the highway is through the village."

"Will everyone and everything in this place be against us?" Again a light, interested tone, the tone in which anybody else might ask if the dessert menu included ice cream.

"Not necessarily," Nia said curtly. "We're caught in a danger game. The zone we skipped was the one called Warway, and I've never been near the war games, and I'd be useless there. But here I know the rules. No, everything and everyone won't be against us, not if we play the game well."

Nia reviewed the guidebook's pages about Davos to make sure she hadn't left something important out of her calculations. At the edge of the village, the highway arched up over a bridge above a sparkling little river that tumbled down the heart of the valley. In the middle of the bridge was a conspicuous plastic trapdoor. The bridge itself was made of rough fauxstone. Interested, Martan stopped to examine the material on the far side of the bridge.

He abruptly looked past Nia, alertness flashing across his features like light reflecting on polished metal. She whirled. Something was climbing out of the trapdoor. Huge, humanoid, wet, and covered with matted hair, it lurched toward them.

Nia dashed to the nearest alleyway. Martan loped after her. In the mouth of the alley, Martan deftly caught and stopped her. "Just stand back and I'll deal with—"

"Don't bother." As they peered out of the alley, the matted monster shuffled back and forth near the end of the bridge, then lumbered back to disappear through the plastic trapdoor.

Martan wore a baffled expression. Nia suppressed an urge to laugh. "That was the troll. It's not supposed to go more than twenty paces from water, those are the rules."

He started to say something, but then his face reflected sharp alertness again. He wheeled around toward two men who were rushing out of depths of the alley. One of the men sprang toward Martan with a knife in his hand.

The other man lunged toward Nia. She twisted away while Martan met his attacker halfway. An instant later, Martan's attacker was slamming into the nearest wall and sliding to the ground. Nia darted behind Martan. Martan delivered a lightning-fast kick to the second man's groin. The attacker doubled up with a yowl of pain. Martan seized the attacker by the throat and hair, yanked him upright, and glared into his eyes. Then the only sound in the sudden silence and stillness was a faint gurgling noise from the attacker semiconscious on the ground. The one Martan had by the throat mouthed inaudible words.

Nia realized that Martan was doing a hellhound interrogation, ransacking the man's mind. Shaken out of her shocked immobility, Nia pulled Martan back by the shoulders. "Don't kill him! If we kill a native, they'll all turn on us!"

Martan let go of the attacker, who collapsed like wet paper. In one fluid motion, Martan picked up a knife on the ground—Nia now remembered seeing him kick it out of the hand that held it—and shouldered their knapsack with its load of rocks again—she thought it had slammed into at least one of the two men at one point. She had never seen anybody move so fast or fight so well. In all likelihood the attackers hadn't either.

Spiders of anxiety skittered up and down Nia's spine. "Come on. Come on." Martan ran with Nia through the alley into a slightly less dank and narrow street. She said, "We are far too obvious. It's our clothes. We've got to do something about that."

Martan raised his eyebrow.

"This way." She threaded her way through the open-air market, closed for the day. The market and the houses and shops nearby were deserted, like the stage set they were. These buildings were mere facades, garish, quaint, and empty.

"Did you inflict—" Why mince words? She knew what he was. She had to find out what he'd done. "Did you wreck his mind?"

"No. He'll wake up with a hangover and a hole in his memory, that's all."

Nia started breathing again. Hellhounds interrogate to get information, she thought. "Did you find out anything?"

Martan nodded. "They're bounty hunters. Past the prospect of collecting a bounty, he was vague about the why. He was clear on who they were after, though. You and any male companion of yours. They knew exactly what you look like. They were after you."

"Me?"

"I can blend into in any crowd, anywhere, but your looks really stand out. I think whoever offered the bounty had the idea of using you as a marker."

A corner of Nia's will wanted to stop and panic, but that was not a useful idea. They had to find real help. She picked an inconspicuous hinged gate and yanked it open to enter a street behind the facades.

"You might thank me for saving you from those thugs," he said.

"But you enjoyed it," she retorted.

Located out of the line of sight from the tourists' deserted marketplace, this looked like a typical neighborhood in the city environs of Wendis. The residences were cozy glassbrick houses, the farthest uphill reached by latticeworks of stairs fringed with potted plants. Each house had a trilingual Wendisan address plate beside the door. The air smelled like any Wendisan neighborhood at suppertime: stir-fry and curry.

The few people on the sidewalks noticed Martan and Nia—visitors in expedition clothes more suitable for the wild zones of the park—but the Wendisans had business of their own and were unconcerned about a couple of purposeful visitors. Nia found the house she was looking for, with a distinctive blue door where the address plate read ELZEBET SELLER. A shiny bellbar underscored the name. Nia pressed the bar harder and longer than she meant to.

The door was opened by a heavy-set,

gray-haired, dark-skinned woman with pleasant, rounded features. "Canter! Quick—in." Elzebet secured the door behind them.

Nia was so relieved to see Elzebet that she felt herself shaking. "This is Night, and—"

"Oh yes, Canter's Knight! The park is witherspin today, and you two are in trouble, but it seems you can take care of yourselves. Now you want some garb so you'll blend in better here! I told my friend Vendana (she's the Gatekeeper's Chief of Staff, she called me right after you left the gate—jumping over from Inferno with Scratch on your heels!) 'Vendana,' I said, 'she'll have sense enough to come to my house as straight as she can get here.'"

Elzebet escorted them to her showroom, which was crammed with colorful clothing arrayed on racks. "These are sorry times, that's all I'll say! Imagine an unsanctioned danger game breaking out in broad daylight with two unwitting university people! Mark my words, an investigation of this will go all the way up to City Council, but that won't help you today—you'll have to rescue yourselves, dear, and I'll do what I can to help. Well, well, you two are the same height! Let's see what I can find for you to wear." Elzebet disappeared into her showroom.

Martan asked Nia, "How well does news travel here?"

"Fast as photons. Tourists can't have communications devices, but the Denizens do and use them incessantly."

Like a wide fish flitting through the tight crevices of its home reef, Elzebet emerged from her showroom with thick clothing piled high in her arms.

"Start with him. I need to use your lavatory," Nia said.

Elzebet's lavatory was a nice little room, too small for the ubiquitous curvature of Wendisan architecture to be noticeable. There was a sweet-smelling bar soap and a real cloth hand towel. Suddenly, in that cozy and familiar place, the shock of danger came home to Nia. She put her head in her hands and sobbed.

An unsanctioned danger game, Elzebet had said. The so-called Most Dangerous Game, even with Old Scratch being a part of it, wasn't really the most dangerous game in Wendis. The most dangerous game in Wendis was *this*. An undesigned game with unknown players playing for high rewards—money, lust, revenge were recurring themes—and playing for keeps.

Nia's tears mixed with the dust of Inferno on her face. The mixture stung her skin. She struggled to regain her composure as she washed and dried her face. Then she opened the lavatory door and froze. She couldn't face any more of this day. She wanted time to stand still. Fresh tears welled up in her eyes.

She heard Elzebet talking to Martan. "Try this one on. Now, I've heard that the new proctor of the university has a fine talent for melting into a Wendisan crowd. He slides into a nightspot in the port looking like a port worker, finds the undergraduates who shouldn't be there, and he's scanned their ID's before their lookouts utter a peep of warning. Good for you. There's too much trouble for young people to get into in that port. Well now, that color does bring out the gold undertone in your skin. A cloak is what a Wendisan man would wear up here tonight, and you've got to act the part if you're to pass for Wendisan."

"I can do that," said Martan's voice. "How did you meet her—Canter?"

"I know her real name is Inanna," Elzebet confided. "That's a fine Wendisan name for a woman and it was her great-grandmother's. Inanna Riga was a famous actress and singer, and I'm old enough to remember the sensation when she upped and married a man from Azure, but Inanna Riga bequeathed her Wendisan citizenship to her great-granddaughter, so that's all right. This cloak will be perfect for you after I adjust it. It's smart fabric, so I can split and rejoin this seam—just stand still. 'Nia' sounds just like a good proper social nickname in Wendis, so she's Nia Inanna to her friends here. A few Wendyears ago, she'd just come to work at the university, and we needed someone to play the role of a Europan queen in the Ascendance Fair. Her legal assistant was on the Fair Committee, and told us his new boss was from Azure with the classic Azurean looks; the pale skin, blue eyes, silver hair. And any good lawyer is a good actor! Everyone immediately realized that she'd be the perfect queen, and she agreed to help us out. She made such a good impression on everyone that she earned a Fair name."

"Canter," said Martan.

"I'm sure Azure is a respectable place with decent people, but really, it's one of those thin new worlds, stretched across a great big planet. She's too extraordinary for it. This is a better place for her. Wendis is nice and thick, like baklava. There! Now the fit is perfect, and it won't get in your way whether you fight or fly."

They'd already had to fight and to flee, and it wasn't over, Nia thought miserably. Was it just bad luck that had made everything go witherspin around them today?

Or was it less arbitrary and more ominous than bad luck? Still standing in the lavatory door, she suddenly recognized a chain of logic as strong as steel.

Only a few days ago, she'd made the initial inquiries for the background legal information she might need to establish Martan's human rights under Faxen law. Now an enemy knew he was here. She'd been careful not to be specific enough in her inquiries to let out the secret that he was alive in Wendis. But maybe she'd not been discreet enough. Maybe there had already been suspicions that the explosion Faxe's hellhound disappeared in hadn't been quite fatal.

If so, then she herself had unwittingly made the first move in the game, not knowing how swiftly the countermove would come. That was the critical core of what was happening today. Martan's enemies wanted him badly. Possibly they also wanted to preempt what she could do within the law to win him human rights and freedom from Faxe. So when she made the mistake of bringing Martan out of the university—one of the safest, best protected places in Wendis—into the wild Wends, a bounty was offered and the hunt was on.

Nia's tearful exhaustion crystallized into focus. The University Counsel said get back to Haven as fast as possible. That was all that mattered right now. Later, Nia wanted the end game to be on her own territory—interstellar law—and she intended to win. First, get out of the park.

She returned to Elzebet's showroom.

Wearing a dark green cloak with a geometric embroidered pattern, Martan gave Nia a slight bow. Somehow he had become a Wendisan man, poised in the spin-gee, relaxed and charmingly sly. Elzebet said, "Look at that. He can imitate the Wendisan male slouch!"

Martan was no skulking assassin. He could blend in with a Wendisan crowd, find out secrets, probably outfight almost anything in the Wends. They *would* make it to Haven, Nia thought, with fierce new hope.

Elzebet said, "For you, Nia Inanna, I have this nice thick shawl. Since your jacket isn't bulky, the shawl goes right over it and it's not obvious that there's a field jacket under the shawl. You'll be glad of the layers tonight with the wind chill. Doesn't midnight blue look good on her? You move like a visitor, you can't hide that—but this is what a visitor with style might wear."

Nia stroked the material. "How much do we owe you?"

"You can't pay for these things with Wendisan yen," Elzebet replied. "For Denizen garb, it has to be native currency. You must cross my palm with silver."

"We don't have any," Nia said in sudden dismay.

Elzebet chuckled. "Oh, but you do." At the kitchen table in her private quarters, Elzebet proceeded to cut some of Nia's hair and rearrange the rest. "There. Paid in full. You look just like a fashionable interstellar visitor, not a university officer. And five years younger, too."

Martan, who had watched the haircut with fascination, nodded agreement.

"Now," Elzebet said, "go to the entertainment quarter and blend in with the other winter visitors until morning!"

"But I was hoping—" Nia stopped. Better not to say too much about their plans. "Can you give us any other advice?"

"Think twice about going down the Highway, or up it. The highway robbers are out and about. Old Scratch has been seen prowling around the Back Gate. I won't be surprised if the Wild Hunt rides tonight. The Huntmaster would give anything to bag Old Scratch. But the Wild Hunt is no time for anyone to be on the Highway," Elzebet said darkly, "least of all a pretty girl. Some in the Hunt are neither sane nor humane, when they're wilding."

"I know." As the Wendisan authorities smilingly told tourists, as they held out forms to be signed, releasing Wendis from responsibility for injury, monetary loss, and accidental death: Welcome to the Wends. Some tourists ended up being pieced together in the hospital, or dead on arrival. More rarely, but not never, Wendisans got killed in the Strange Range. Nia slowly reached into her jacket pocket. "Would you keep something safe for me?" She took the hugwort out. But it clung to her buttons. It thinned and spread out as she pulled it, but it refused to let go.

"What in all the worlds is that?" said Elzebet.

"An enchanted morning glory," said Martan.

"It's a species the university biologists found on the planet Jumala," said Nia.

"Look at those leaves—just like the glories outside my back door!"

"It may be a created organism, a teratism," said Nia, losing her struggle with numerous wiry green tendrils. "They think there was a lost human colony on Jumala. On Jumala the ecosystem is bizarrely dominated by plants. There is some evidence that an ancient colonist mixed Terrestrial genes into a Jumalan life form, before the colony died out."

"Teratism or not, dear, it's certainly attached to you."

"It may be hurt already," said Nia, "and there aren't many like it."

Martan sniffed the hugwort. "It doesn't have any bruised leaves. It's not all that fragile. It wants to take its chances with you."

Nia reluctantly returned the hugwort to her pocket, untwining the last tendril from her index finger. She wrapped the shawl around her shoulders. "We've got to go."

"Have this too." Elzebet fastened the shawl with a slim golden pin bearing two faceted stones. "It's a nice finishing touch and a token."

Nia gratefully closed her hand around the pin. "Will you be safe after we leave?"

"I live in the Fair Country. My door is better defended than it may look to you, and I'm staying behind it until this trouble blows over. Remember, now, I say wait for tomorrow before you try any more gates. You can easily pass for two of two dozen lovers romancing in the Fair Country tonight. At least, use those Wendisan yen of yours to get a good supper!"

They were two of thirty people dining on the restaurant's patio. The windows and door of the restaurant, closed against the cold night air, leaked syncopated music. From the patio around them came the murmurs of other diners and the clinks of cutlery in use. Naturally enough in the outdoor chill, Nia had her shawl's hood up, covering her telltale silver hair, and she attracted no attention at all. But her nerves stayed strung tight.

Martan pointed to her plate. "Are you going to finish that?"

"How can you eat?"

"I might need the calories later."

She shoved the plate, with a third of a trout and two thirds of the rice, toward him. "I can't feel hungry when I feel in danger."

"You may not be in much danger. They may just be using you as a marker, remember?"

"But if it were me, and I wanted to extract you from asylum in Wendis by foul means, I'd capture or kill the only lawyer in Wendis who understands interstellar law well enough to defend you against Faxe. I made the first inquiries for legal background information just five days ago. I was very careful, and I didn't expect it to precipitate something. But it might have."

He held her eyes in his own dark gaze for a long moment. "Eat. You might need calories later too."

She nibbled a curry bun from her side dish. "Are your modifications psychological and mechanical or genetic?"

"Does it matter?"

"There are legal protections for cyborgs. The gene-changed are a lot harder to protect, because they're a lot harder to deal with . . . and unpopular. Wendis has treaties with a few gene-changed communities. You aren't a species, are you?"

Martan shrugged.

What had he told her earlier, about brain-training to make hellhounds reluctant to spill their secrets? "If I know what you are, I can help you," Nia persisted.

It seemed to take effort for him to say, "Martan is an alias. No radiation-mutated ancestors on Old Mars. I have old Earth normal genes. The changes were mechanical and psychological. The doctors here could have undone the mechanical changes—except—I didn't want to lose all I can do."

Nia felt as though he'd opened a window into his soul and she'd seen one of the main cogs in his being. "You wanted to be a hellhound, but a redeemed one?"

"You could say that. What's so funny?"

"The university hired you as proctor," said Nia. "You can see in the dark and hear fog flow. You have a grip impossible for a normal person to break. Those undergrads sneaking to forbidden places after curfew don't stand a chance."

"Unfair advantage?"

"Doesn't matter. Your predecessor was an incompetent political appointee. The whole faculty and administration of the university is glad to have a capable proctor for a change. They just don't know how capable!"

Martan divided the last of the tea between her cup and his with a flourish, making the amber liquid slant to its destination instead of allowing porcelain to click on porcelain. Even if he'd had to struggle to say the truth about himself, he liked being admired for what he truly was, Nia thought. There was a lot to admire. "And you're polished. You're well educated. You fit in with the university culture. I thought you said you were born on Estrella."

"Estrella is backward, all right, but I had a first-rate education after my juvenation and training. Lessons in etiquette, too. If we came off like jackals, we'd never accomplish anything." He smiled.

Nia smiled back. Not just a slinking assassin, she thought, and not a monster. In fact, he was wonderful.

Martan said, "I just remembered something. The thug thought a Jeng Family was behind this—that the Jeng Family had a bounty on us. One of the enemies of Faxe I eliminated was named Jang. Could there be a connection?"

Nia sat back, suddenly uneasy. "The Jeng Family has relations Outside. Some of the Outside Jeng are very rich from interstellar trade, but not particularly political, that I've ever heard about. Jang might or might not be an Outside variant of the family name. What did your Jang victim do to get on Faxe's list of enemies of the Faxen Union?"

"He was a religious cultist. A Shandiist."

Nia could hardly believe her ears. "As in Shandy? Do you know about Shandy?"

"Some kind of supposed god."

"More like Satan. And Shandy has worshippers in the Wends." As if they needed an unholy new twist in this game! "The low road is out. We don't dare go that way, not if Shandy's followers might be behind all this."

Martan surreptitiously emptied her dipping sauce and his onto the remaining rice, and ate it in large spoonfuls.

"What are you doing?"

"The sauce is mostly oil. Good source of calories. Let's wander over to the edge of the terrace and admire the scenery, while I listen."

Martan's supersensitive hearing must have picked up something, and he wanted to listen away from the noisy patio, Nia thought, getting up from the table with him.

A wrought iron railing at the edge of the terrace offered a scenic view of Davos. The village lay on the slopes of its mountain like a thick rug shimmering with soft warm lights, apparently peaceful. But Martan indicated the far side of the village with an unobtrusive tilt of his chin. "I hear your Metal Man. The anthropologist. He's running on the highway into town yelling, *the crusaders are coming*."

Nia recoiled. "Oh no! That's worse than highway robbers! They could lay siege to the village until every visitor is handed over!"

"Maybe by warning everyone in earshot, he's trying to warn us," said Martan. "We better get out of here."

A tall fence separated the village from the forest on this end of Davos, but a silvery stream—a tributary to the small river in the center of the valley and village—raced downhill under the fence, flowing through a tall tube as a shallow clear layer of water.

They dropped down onto the stream and waded uphill, through the tube, into the forest. On the other side of the tube high banks rose on either side. The streambed was smoothly pebbly. It would wash away their scent if something came after them that could smell spoor. But the water was snowmelt, and icy when it flowed into Nia's shoes. "My feet are cold—"

At that moment, something separated itself from the dark bank ahead. It loomed up over them. It grunted gloomily.

Martan glared up at the troll. He pulled out the thug's knife, ready to use it.

From behind Martan, Nia grabbed his upper arms. "No!"

"Why not?"

"Watch." She took Elzebet's golden pin with garnet stones off the shawl. She held the out to the troll.

It stooped. A huge blunt thumb and index finger delicately closed on the pin and took it. Then the troll chuckled and shuffled back into a den in the steep bank.

Nothing but a reek like wet dog mixed with curry came out of the troll's den as they hurried by. The troll did not reemerge.

"What was that all about?"

"It's the rules," said Nia. "Give him jewelry or coins and you can pass."

Martan swore under his breath and slipped the knife back into his pocket.

Nia promptly tripped on a loose stone, going down on one knee with a chilling splash. Martan helped her up. A quarter mile further upstream, they crawled up the stream's bank. Nia was shaking with cold, and her knee hurt.

Martan sat down with her and wrapped his cloak around both of them.

"I want to be home in my own bed tomorrow morning with this a bad dream!" Nia said through chattering teeth.

Martan rubbed her knee and held her close. He felt incredibly, miraculously warm. Nia gratefully rested in his arms.

They were high on Zaber. Low-lying fog dimmed the distant city's lights to a misty gleam. But the center of the huge cylinder of Wendis was clear. The whole length of the sunspar was visible along the axis. It was night in Wendis now, and stars and nebulas streamed through the spar, images that imitated the cosmic environs of Wendis. The cylindrical city-state rotated once every five minutes, but to anyone in the sway of the centrifugal spingravity the cylinder seemed fixed in space, an immutable frame of reference, with a river of stars flowing through its long crystal heart.

The most distant mountain in the Wend Range, Mount Chance, had a jagged peak that gleamed in the starlight. Specter loomed higher and nearer, made of darker stuff. All of the mountains of Wendis were curved like waves—and all of them had vertiginous blank backsides—but only Specter carried the pattern to completion. The black summit of Specter curled around the spar.

Martan was looking up at the mountains too, with observant eyes that had seen other great and beautiful wonders, as he'd told her only a few hours that felt like a lifetime ago.

Some interstellar wonders were very small. Nia checked her jacket pocket under the shawl. "It's all right. It may not be so eager to smuggle itself along on an outing next time."

"Where to now, Inanna?" he said.

He'd never called her Inanna before. Maybe he liked the name. She liked hearing it in his voice. For the first time in her life, that very Wendisan woman's name felt like it belonged to her. She was in the middle of the most dangerous game in Wendis, with a companion who was as dangerous as anyone in the Wends, but willing to follow her lead when she knew the way better than he did. She said, "The last tram to Haven leaves at midnight. We're in the highlands already. If we cut cross country to the Fair Lane, we'll have time to catch the tram."

They started across a meadow carpeted with short, springy grass.

"What if something goes wrong with the tram plan, too?" asked Martan.

"At the top of Zaber is Lover's Leap."

"That sounds suicidal."

"It isn't. If you leap off, you fall down the back side of Zaber into a net in Haven. But I'd never live it down at the university."

He may have been imagining the net with as much distaste as she was. That or something else was distracting him from listening for warning sounds. Nia and Martan both registered hoofbeats racing up behind them at the same moment, too late.

A shape like a slender white horse dove between Martan and Nia, knocking Martan backward. It sidled on mincing hooves, pushing Nia away from Martan. Starlight glanced on a sharp, fluted horn.

Nia tried to duck around the unicorn. Very pretty and very assertive, the unicorn blocked her, dancing sidewise on long delicate legs, driving her further away from Martan.

"Stupid beast!" Martan exploded.

Nia called back, "He's not stupid. I've met him before. He won't hurt me, but he's herding me. Prince, stop that!"

"We don't have time for this!"

"You tell him!"

Martan seized the unicorn's horn. Prince furiously tried to shake loose, but Martan kept his grip on its horn and bared his fangs while staring Prince in the eye.

Flank muscles tensing, the unicorn jumped straight backward. Martan let go of the horn just in time not to be carried along. The unicorn whirled and bounded away with its tail flowing like a gossamer pennant behind it.

"He got the point," said Nia, rejoining Martan.

They scrambled up the rocky bank to

the Fair Lane, which was paved with flat fauxstones. The Lane curved uphill, offering easy going the rest of the way to the tram station.

As they paused beside the lane, Nia wondered about the unicorn's reaction to her, and Martan's reaction to the unicorn. Had that been two males fighting over her? Prince had certainly been radiating male attitude. And now so was Martan, who had not retracted his fangs. Nia reached out to Martan's lips, exploring his fangs with her fingertips. "Oooooh. Sharp."

"Do you want me to put them away?"

"I'm beginning to think I find them strangely attractive."

He kissed her fingertips and pulled her closer.

Then an ululating sound ripped through the air, like a wail from a raw brass throat. Nia groaned. "It's the Wild Hunt. We can't go to the tram now. That's in their territory. God help us if someone told them what you are. Your pelt would be a bigger prize than Old Scratch!"

"How do we reach Lover's Leap?" Martan asked

"Up the lane, and turn at the intersection onto the High Road, and up and up and up."

The Wild Hunt horn sounded several times more, and more wildly, but not any closer. The Hunt was staying on the other side of the Fair Country, in the rough terrain near the Back Gate where Scratch had been seen earlier. Old Scratch might be a prize they could not resist.

"Better Scratch than me—or you," said Martan.

This high on Zaber, the air was thin and bitterly cold, the gravity low and hard for Nia to manage. She slipped her hand into Martan's. She'd stopped being afraid of him. She was afraid, but not of him.

"Your hair is exactly the same color and texture as the unicorn's mane and tail," said Martan.

She shrugged wearily. "Probably the same genes. The unicorn is a teratism that dates pretty far back. Some of my distant ancestors on twenty-first century Earth had silver hair, but it was early genetic engineering rather than a naturally evolved trait. Everyone else now believes the old families on Azure are pure Earth-original genetic material. But that's not exactly true. Family secret. Don't tell." Her family's secrets must seem like feathers compared to the weight of the secrets on his shoulders, she thought.

Martan stroked her wrist. "You see, it's not automatic," he said. "All of my fingers are touching your skin, and nothing bad is happening."

"I saw what you did in Davos," she answered, but she didn't pull away.

"I really had to dig," said Martan. "There wasn't much in his mind for me to work with, because he just wanted a fat bounty. My telepathy drives along the tracks laid down in someone's brain by pain, shame, and anger. The enemies of Faxe tended to have a royal road for me in their minds. That last night when we were together, as soon as I touched those scars on your back, I knew somebody had hurt you, and then you told me it was an early and very unsuccessful experiment in love. It carries pain and shame for you now. I instinctively reacted to that, and made you explain everything. But you are the last person in the universe I intended to Interrogate. I'm sorry."

It made sense. He made sense. Finally she said, "You told me you made a drastic, emotion-driven, foolish decision at a young age. Well, so did I. It's in the past now."

"If you say so."

She squeezed his hand.

Martan said, "It was an Interrogation that made me defect from Faxe. I hunted down my last enemy of Faxe, and when I interrogated him, I found that he was a principled man, not a nihilistic terrorist. Things he knew about Faxe shocked me. I broke the Interrogation off—ran away—and tried to end my life in an explosion. Except I didn't die. Wendisans rescued me. Then the doctors reconstructed me, learned all about my hellhound modifications by repairing the damages. They restored my abilities. It's more than telepathic interrogation."

"I understand that now." A hellhound was a subtle tool as well as an effective and terrible one. No wonder Wendis had been interested enough to rescue Martan, repair him, and finally offer him asylum and a useful job. It was very much the tradition of Wendis to gather up resources, human or otherwise, that added value.

"I like the things I can do. But I'm not Faxe's hellhound now."

No, she thought, he was not a Faxen hellhound anymore. He might just be a Wendisan hellhound.

They rounded the bony flank of a rocky hill. The High Road ended just ahead at a fragile-looking swinging footbridge suspended over a chasm.

A figure like a winged gargoyle crouched on the anchoring post on the near end of the bridge. Both the bridgepost and the gargoyle looked made of pale marble and were of incongruously imposing size compared to the spindly bridge.

Nia drew close to Martan. "Watch out for the guardian Angel," she whispered.

As they approached the threshold of the bridge, the guardian Angel watched them with live, shifting eyes. Martin pulled out the thug's knife. The Angel's head turned toward them as they went by and stepped onto the slender bridge.

"Suspended at forty-five degrees to the axis. That may make it a little challenging for you," Martan murmured. "Walk fast but lightly, smoothly."

With every step, it felt as though a subtle, invisible spingravity finger nudged Nia's foot toward the edge of the bridge. It made her fear falling off. Panicky, she said, "It feels—"

"Close your eyes."

With her eyes closed, Nia clung to the arm Martan put around her waist, guiding her. He glided right behind her, his footfalls so light that they didn't even seem to register on the bridge.

Music and faint laughter drifted up from the deep valley far below the swinging bridge. Colored lights swirled on the valley's floor. That was Karnivale down there. No carnival for anybody who fell off this bridge.

"We're past the middle," Martan said in a low voice. Nia heard a flapping sound behind them. "Now hurry—" Martan shoved her the rest of the way to the end of the bridge, where she felt solid rock under her feet and stumbled.

Martan whirled with the knife ready in his hand.

The guardian braked in midair with flapping wings. He dived onto the anchoring post. With long, bony hands, he grasped the knotted ends of the bridge and unfastened the ropes. Dangling from the Fair Country end, the bridge slowly fell away.

The guardian spoke. "The way is closed."

Nia shuddered. Even more than the deathbird, the way that winged parody of a human being flew in the air of Wendis looked hideous to her. But Martan didn't seem fazed. Holding her hand, he backed away from the bridgepost, trading glares with the guardian Angel all the way to the foot of a long stairway carved into the vertical face of rock at the high end of Karnivale.

"Up to the top of Zaber," Martan told her. "It's not far."

Nia shook her head, despairing. This looked even worse than the Spiral Stair. The frigid wind galed and sighed. The ends of her shawl fluttered. Her muscles fought for balance, and she forced herself to suppress motions too forceful for the low spingravity.

Martan coaxed her up a step at a time. He ceaselessly scanned the stairs and the air for danger. "What is that thing?"

"He's not a thing. He's human. There are two groups of genetically changed—or deranged—humans in Wendis. One is the Children of Bane. Like the Gatekeeper. The other is the Angels. They're Shandy's Angels."

"Do say," Martan replied, with a cold ironic note in his voice that she'd not heard before. But then she'd never heard him contemplating a sentient enemy.

Nia dared one look back. The guardian Angel glared up at them with his wings cocked.

One minute of inattention on Martan's part and the Angel would fly up to knock them off the stairs. But Martan's alertness didn't waver.

On the first landing, hidden from the bridgepost by a fold of stone and out of the wind, Nia stopped. Her leg muscles trembled with fatigue, and the knee that she had bruised in Inferno and again in the stream near Davos throbbed. Icy tears tricked down her cheeks. "I can't take much more of this."

Watching the air with the knife in his hand, Martan kissed the side of her face. "I'm sorry. If I'd known, I would never have let everything today happen to you."

She said, "I knew it might be dangerous to help you. I just didn't think it would be this much, this soon, like this. But . . . I knew." She leaned against him. Elzebet's cloak smelled like the Fair Country, spice and smoke.

She'd known, and she'd made the first move of this perilous game herself, by sending out inquiries into areas of interstellar law that might have bearing on the human rights of hellhounds. And her motives had been a tight braid of ambition, compassion, and sexual passion. How very Wendisan. Wend your way, play a game, win or lose the prize of your life in the Magic Mountains . . . .

Martan sounded calm. "I will get you home tonight. I promise." He pulled out the guidebook from her jacket's breast pocket. "Be our lookout for a few minutes."

Nia anxiously watched the windy air.

Martan leafed through the guidebook's pages. "Zaber's peak has very unusual properties," he said. Faint accordion and zither music drifted up from Karnivale. He turned a page. Suddenly Martan hissed, "This thing is transmitting! I feel it. Only when a page turns—and only sneaky little packets of data."

"Telling someone where we are?" Nia's mind reeled.

Martan hurled the guidebook into the valley. It fluttered away on the winds over Karnivale. "I memorized what I need," he said. She felt his back muscles tense up and his breathing change, deeper and harder. He was spring-loading for a fight.

The stairs ended on the wider crest of Zaber. Starlight shone blindingly on a thin blanket of snow. Nia located Lover's Leap, a scalloped terrace protruding from the top of Zaber.

It was roped off and posted with signs.

CLOSED FOR MAINTENANCE
NO TRESPASSING
NO SAFETY NET

"Company," Martan said flatly.

Nia turned around to see four humans standing up from the snow, wearing arctic-white hunting garb and masks, with weapons in their hands. A harpoon was flying through the air toward her.

Martan shoved Nia down onto the snow. The harpoon harmlessly skimmed his shoulder. He tumbled over Nia's back, skidding over the vertical edge of Karnivale valley. She grabbed for him, missed, and watched horrified as he fell. But not far. He slid toward a tiny shelf of rock. His feet landed there. Terror for his safety choked Nia's throat. But he coiled onto the shelf like a spring, balanced on the balls of his feet, safe. But he had nowhere to go.

Nia forced herself to roll toward the hunters, to get to her feet. She must not let them know he was safe, just below the edge. She had to get their attention away from him. She took a shaky step in the low gravity. The hunters advanced. One of them shook out a huge net.

Out of the corner of her eye Nia registered rapid motion just before Martan hurtled into her. He collided hard with her and launched them both into the air. He'd jumped up from his narrow perch with all the power he had. He'd broken both of them free of the low spingravity. With his arms wrapped tightly around her, they coasted upward from the peak of Zaber.

The mountain rotated away. The hunters gestured excitedly. But they didn't shoot another harpoon. Nobody in Wendis would dare fire a weapon toward the spar at the center of the world.

The spar was a torrent of brilliant stars channeled inside a thick crystalline tube. It mesmerized Nia. The heart of the spar was filled with translucent threads, conduits for a sunlike pulse of golden light by day and a million starlike pulses of silver light by night. It was blindingly bright up this close. The air around it was warm. Nia felt numb awe as she saw the spar up close, and closer yet.

They were going to collide with it.

Martan reached out and put his hand on the spar. His arm absorbed their momentum. Electrical fields swirled around his hand on the spar's clear surface.

With a forceful shove, Martan propelled them away from the spar.

Now they fell at the same slow rate at which they'd ascended from Zaber. As dazed as if she were dreaming, Nia saw they were coasting rimward on the other side of the spar from the peak of Zaber, where the distant hunters had dwindled to angry little toys. Martan and Nia fell rimward, down, and down. But it didn't feel like falling. It was dreamlike flying, free from spingravity. The whole vast cylinder of Wendis rotated around them.

Martan shrugged off the knapsack, which still contained rocks from Inferno. He slung the whole thing away from him, changing their course so that they coasted rimward at a different angle. "Hah! We'll land safe!" he exulted.

Now Zaber rotated back around.

Zaber morphed into an immense white wave looming over them, closing in with terrifying speed. Nia screamed. Martan twisted around to cushion the impact with his own body. The steep slope of Zaber slammed into them and buried them in snow.

They rolled back out into the air. Nia coughed and spat snow. They slid downhill. Snow slithered through Nia's clothes.

Martan shouted a curse. "No rock—no roots—can't stop!"

They kept sliding downhill toward a dark flat blur on the mountainside. A fragment of Nia's mind worried what the dark blur was—it looked familiar—bad for some reason—

Nia, Martan, and the snow traveling with them spilled into an ice-rimmed lake. Frigid water shot through Nia's clothes like driven nails.

Martan hauled Nia up, getting her head out the water. She coughed. The lake came up to her collarbone, and it was shockingly cold. "Aaaah!"

"This way!" Martan gasped.

She staggered toward shore leaning on him.

"I think we're safe," said Martan.

Shaking uncontrollably, Nia looked at the shoreline. It was familiar. It was also lined with people staring excitedly at them. "Robin Lake in Haven," Nia stammered past chattering teeth. "Winter stargazing. We are safe here. Oh, cold! Oh no!" She fished the hugwort out of a pocket full of water. It clutched at her fingers with all of its tendrils.

They waded out of the water onto a smooth sand beach. Water spilled off Nia's shawl and flowed off Martan's cloak, as the fabrics rejected the water.

"Here!" Martin flung his cloak and her shawl around them both. He twined his fingers through the hugwort's tendrils and between Nia's fingers. He embraced her, and he radiated heat. Another special hellhound ability, Nia realized. Raise body temperature. Survive immersion in cold or snow or ice water. She held onto him, sharing his elevated body warmth. The hugwort relaxed its grip on Nia's fingers and twitched its tendrils, flinging water off its leaves like a wet bird shaking its plumage dry.

"A flying ambulance just landed," said Martan. "Don't forget I kept my promise to you."

Nia held his face. "You—are—wonderful!" She kissed him. He responded instantly, but he held back, implicitly asking how much kissing she wanted and how long. Her answer was *more* and *very*.

"What happened?" said an ambulance medic pushing through the cluster of people. Voices answered, "They fell down the mountain—caught in an avalanche—" A child piped, "They fell from the starspar, they did, they did!"

"Anyway, they seem to be all right," someone remarked.

Nia broke off the kiss but whispered to Martan, "More later!"

Then there it was, finally, with ice water dripping from his hair onto his face, he gave her his end-of-an-eclipse smile.

They shook off the curious star-gazers, including one who seemed to be an ambulance-chasing reporter, by ducking into the Robin Lake boathouse. Since it was winter, the boats were tied and covered. Martan led Nia along the floating dock in the darkness, unerringly reaching the far end of the long boathouse while the reporter and other curious citizens were still blundering around near the door they'd entered by.

Martan was breathing hard, and he was shaking. "Hungry," he whispered, while the boats around them creaked and muttered in their moorings. "Used up a lot of energy."

Nia cautiously cracked open a back door of the boathouse. She saw a crowd of people scattered on a slope of Zaber that faced the city. Viewing the glittering skyscrapers and shining scraps of fog that filled the far end of Wendis like a geode, these people hadn't noticed anything sliding into Robin Lake behind them. Nia put her shawl over her hair and led Martan by the hand. They merged into the crowd.

Sweet smoke led Nia to a food vendor's booth. She bought a fried cake and six winter rolls. Martan ate the rolls while the cake cooled, then wolfed down the cake. Then he smiled.

"Happy now?" Nia asked.

"You were right. It's the best obstacle course that ever existed. That was a good run. I'm very happy."

Nia liked being right. But she was aware of Zaber's bulk curling up toward the spar, looming over them like a live, imposing presence. "You know you have enemies up there."

He smiled again, with a glint in his eyes. "Dealing with enemies was what I was made for."

He had his idea of an exciting challenge. Nia had hers. If the Jeng Family tried to pursue a vendetta against Martan, they would find themselves in serious trouble with the Wendisan legal system. Nia would see to that. If the Shandiists weighed in, then things might get legally very exciting—as well as dangerous. But when you could play danger games in the Wend Mountains and win, it was only natural to have both bad enemies and good friends and allies.

"What about you? Happy?" Martan asked, stroking the side of her face.

"I'm so glad we made it down, but I'm worn out," said Nia. She was trying to ignore her scraped skin, muscles taxed into painful knots, and fatigue building to crushing proportions.

A quarter of the way around Wendis from here, the university stood on the low hills, surrounded by a decorated wall that was also very functional, designed to keep students and scholars from outside worlds safe from the dangers of Wendis. "You said you wanted to be in your own bed tomorrow morning, and it all be a bad dream, but I'd like for you to come home with me," said Martan. "The proctor's apartment is secure by design. And I made security improvements since I moved in."

To reach the university only took a short walk downhill and then a brief slidewalk ride. There was a narrow Proctor's door in the wall beside the university's main entrance. Martan's keys opened the door and then locked it with several layers of security.

"Happy," Nia murmured, falling asleep in Martan's arms in the safe darkness of the proctor's apartment. ***Win the prize of your life in the Magic Mountains*** .... "Very happy." ■

IN TIMES TO COME

Our September issue features a wide variety of stories that turn familiar ideas and situations on their heads, challenging you to think about them in new and perhaps uncomfortable (but entertaining) ways. Richard A. Lovett's "A Pound of Flesh," for example, offers a scary way an old truism might be put to all-too-practical use. Rajnar Vajra's "A Million Years and Counting" stars a protagonist as outrageously alien as you've seldom seen elsewhere but likely come to expect from Vajra—yet in the end perhaps much more familiar than some would like to admit. John G. Hemry's "Kyrie Eleison" is a tale of reunion in an age when humanity has expanded far beyond the Earth, wherein a rescue team discover a startling example of "making do" twisted to sinister new ends.

Kyle Kirkland's fact article is "The Right Stuff: Materials for Aerospace and Beyond." What you can build depends, of course, on what materials you have available to work with—and we're just now seeing the beginnings of some new ones that are not only very exotic, but very "talented." Finally, of course, we'll have the sweeping conclusion of Edward M. Lerner's four-part novel *A New Order of Things*.

Science Fact

Messengers From the Earth's Core?

The Great Plume Debate Heats Up

Richard A. Lovett

For vacationers, Hawaii means paradise: a fertile chain of volcanic islands, bedecked in rainbows and flowers, bathed by the Pacific Ocean. But geologists would love the islands even if the climate weren't so appealing. That's because they are the most active volcanic area in the world, in a region where, for years, it appeared that volcanoes had no right to be. Hawaii was a tropical paradise that, quite simply, seemed as though it shouldn't exist.

Then, in 1971, a Princeton University geologist named Jason Morgan offered a bold explanation: suppose there's a hotspot on the surface of the Earth's core. Why, we don't know. Maybe it has something to do with the way heat escapes from the core's interior, or perhaps it's simply due to a pocket of radioactive materials. Whatever the cause, the spot acts as a geological hotplate, producing a thermal plume that rises through the Earth's mantle until it eventually punches through the surface and emerges as—hurrah!—a big volcano. Since hotspots can presumably be anywhere on the core, hotspot volcanoes can be anywhere on Earth.

By the end of the twentieth century, this once-revolutionary theory had become conventional wisdom. But is it true? Sometimes, universally accepted theories are the ones that least stand up to challenge: consider the fate of the

Ptolemaic view of the Solar System or the pre-Einstein view that the speed of light was fixed, relative to a stationary ether.[1] Now, a small group of geophysicists are unleashing a firestorm of controversy by arguing that the hotspot/mantle-plume theory might not be as correct as everyone has presumed.

The birth and death of such theories is simply part of the cycle of science. But many geophysicists are rooting for the old theory to hold correct. Many years ago, Jules Verne's classic novel, *A Journey to the Center of the Earth*, postulated an expedition to the Earth's core in which the explorers descended the mouth of Iceland's Snaefellsjökull volcano, and kept going downward for a long, long way. In the (scientifically dreadful) movie *The Core*, modern explorers took a faster route via an extraordinary burrowing machine.

Real scientists have no hope of such adventures. But if the hotspot theory is correct, they don't need them. That's because the core—or at least material that has been in contact with it—may have come to them via hotspot-derived plumes. "If there are no plumes, it will be a great disappointment," says Donald J. DePaolo of the University of California, Berkeley. "The romance of plumes is that they are messengers from the bottom of the mantle, and they may be our only chance to get direct information on what's down there."

Peeling the Onion

To understand why the theory is under attack, we must begin with a primer on the Earth's interior. It is comprised of three basic layers. The uppermost is the lithosphere (also called the crust), which is where we live, drill for oil, dig mines, and collect samples for laboratory analysis.

The lithosphere is comprised of two basic subdivisions: seabeds, which are made of relatively dense basalt and are only about ten kilometers thick; and continents, which are made of lighter-weight granite and which can be up to sixty or seventy kilometers thick. Both, of course, contain numerous impurities, ranging from sedimentary rocks and precious minerals to organic matter such as oysters, tree roots, and *Analog* readers.[2]

Beneath the lithosphere is the mantle. It appears to have two distinct sub-layers (called the upper mantle and the lower mantle) with a boundary between them. This is important because the boundary may impede the movement of plumes rising from the lower mantle, and it definitely impedes our ability to figure out what's going on below it.[3]

The mantle is denser than the crust, so the crust floats on top of it. Although the mantle's average temperature of about 2000 °C is hot enough to melt rock, the rock is under so much pressure it remains solid. (Unlike ice, rock expands when it melts, which means that pressure prevents it from doing so.) However, the mantle rocks are very slightly plastic, which means that they can flow—very, very slowly.

Because it is heated from below, the mantle contains convection currents, like a very thick, slow-boiling stew.

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[1] Ptolemy was the ancient astronomer who developed a complex Solar System model with the planets revolving around the Earth. Ether was the invisible medium through which light waves supposedly propagated, like sound waves in air.

[2] Okay, so I'm being cute. Some folks would say that the biosphere is a thin layer, distinct from the crust. But crustal geology and biology are strongly enough linked (think about the processes that form coal, oil, and limestone, for example) that this is an artificial distinction.

[3] As we'll discuss later, our primary way of "looking" at the mantle is by the way it conducts seismic waves from earthquakes. To the extent that seismic waves reflect off the boundary rather than passing through it, all you see is the boundary.

"Slow" is the operative word. Most scientists believe that plumes are the racehorses of the mantle world, and are galloping along at a pretty good rate if they hit speeds on the order of a foot per year.[4]

It is only when a hot portion of the mantle comes close to the surface that the pressure drops below the critical threshold at which it finally melts. Geophysicists refer to the resulting liquid as "the melt." Most people call it magma.

The mantle is about 2,800 km thick. Beneath it lies the core, which also appears to have two layers. The core is the least-understood part of the Earth, but all that matters for us is that it's hotter yet (about 3000 °C), and that there is a distinct boundary between it and the mantle. Just as the burner of a stove provides the heat that causes your dinner to boil, heat from the core drives the mantle's convection currents. Hotspots, if they exist, simply provide unusually strong focal points for the same process.

When the mantle's convection currents reach the lithosphere, they buffet it like bubbles floating in a hot tub. The result is that rather than being a single eggshell layer coating the entire planet, the lithosphere is broken into about thirty plates, each moving independently in a process called plate tectonics. Sometimes plates bash into each other, producing enormous mountains, such as the Himalayas. Sometimes they grate against each other, producing zones such as California's San Andreas Fault. Sometimes, they rift apart, allowing magma to upwell from below, and on still other occasions, one plate dives beneath another, melts, and comes back to the surface a hundred miles or so away as a chain of volcanoes, such as Oregon's Cascade Range.

Plate tectonics works perfectly well without mantle plumes. But the standard theory doesn't give you Hawaii, because Hawaii is smack-dab in middle of a plate.

If a mantle plume were to erupt beneath a stationary plate, the result would be a single, enormous volcano. This, in fact, is one explanation for why Mars, whose crust is one large, unmoving plate, sports enormous volcanic cones such as Olympus Mons. But if a plume erupts beneath a moving plate, what you'll get is a chain of volcanoes, as the continuously upwelling magma punches through first one weak spot and then another, as the crust drifts by. The young, active volcano (or cluster of volcanoes) will be at the site of the plume. Farther away, extinct volcanoes will form a nice, nearly straight line, marking the direction in which the plate is moving.

In Hawaii, this is precisely what you see. The Pacific Plate is moving northwestward at about seven centimeters per year, or seventy kilometers per million years, and the islands run in exactly the right direction. Farther out, beyond the last island, the line continues in a string of underwater mountains known as the Emperor Seamounts.

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[4] There are old science fiction stories that feature deep subway-like tunnels through the mantle. From a physics point of view, these stories are fun because, if the tunnel carries a hard enough vacuum and the train has low enough friction, it's a quick, low-energy way to go thousands of miles: you simply let the train roll down the hole, gathering speed as it goes, until it reaches the bottom and is carried back uphill by its momentum. From a geophysics point of view, though, the concept is nonsense. Not only does it require a monstrous air-conditioner to keep from melting the train, but the tunnel walls need to resist pressures that make those in the deepest ocean trenches seem trivial. If you accomplish all of that, you still have to deal with those pesky mantle currents, which are going to throw the tunnel out of alignment. Of course, those old stories were written back before anyone had dreamed of mantle currents, so the authors can be forgiven for overlooking them.

As you move down the chain, the islands (and seamounts) become increasingly old—exactly as they must if the theory is correct, because the farther you go, the longer it's been since they were atop the hotspot. The islands also get smaller, but this doesn't mean the hotspot has changed intensity; rather, the inactive volcanoes have been eroded until nothing remains but stubs.

There is one anomaly, but it is easily explained. About 4,000 kilometers from Honolulu, the Emperor chain shows a distinct kink—a 60-degree bend to the northward. How can a hotspot track produce a kink? Easily, it turns out. Crustal plates are always bumping into each other, and the collisions can cause them to change course. Presumably, something deflected the Pacific Plate at the time these volcanoes were active, causing it to start tracking at a new angle. The kink is one of those anomalies that reinforces a theory because, in retrospect, it should have been predictable.

Hot LIPs

The mantle-plume theory is the type of insight about which most scientists can only dream. In one simple stroke, it explained all the puzzles about Hawaii. Needless to say, geologists soon began applying it to other anomalous volcanoes. Today, there are at least 73 suspected plumes, according to a list compiled by Don L. Anderson of the Seismological Laboratory at California Institute of Technology.[5]

The most obvious candidates are island chains: the Galapagos, the Canaries, Tahiti (and associated seamounts), the Azores, and many more. Another candidate is Iceland, although it's a bit different because instead of being a chain of islands, it's a single big one: more like Olympus Mons than Hawaii. The explanation is that Iceland straddles the rift between the North American and Eurasian plates, so that while plate tectonics are ripping the island apart, its center stays put, atop the hotspot. This allows the hotspot to keep pumping magma upward, continuously filling the gap.

In principle, there is no need to postulate a hotspot to explain Iceland: something similar occurs at any place where crustal plates are pulling apart. But Iceland is unique because of its size. Something is pumping up a lot more magma there than elsewhere, and hotspot hunters believe they know the answer.

So far, we've only looked at plumes that erupt beneath the sea. What would happen if one encountered a continent? Rather than a chain of islands, you should get a swath of lava flows. The best known of these (presumed) continental hotspots is the Yellowstone Hotspot, which appears to have originated beneath eastern Oregon, Washington, and California. From there, its track moved eastward (as the continent moved westward), creating the Snake River Plain. Now, the plume provides heat for Yellowstone's geysers.

The Yellowstone Hotspot also illustrates what hotspot believers expect to happen when the core develops a new hotspot. At a rising rate of a foot per year, it takes several million years for the plume to reach the surface. En route, traditional theory says it should develop a mushroom shape, with a broad, flat head, and a thinner stem.[6]

When the plume hits the surface, that broad head should produce mammoth "flood" eruptions spread across enormous areas—and this is precisely what we see in the inland Pacific Northwest. The region is dominated by flood basalts, up to 15,000 feet thick, sprawling across an enormous chunk of Oregon and Washington, plus pieces of California and Nevada.[7]

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[5] Anderson's list, with latitudes and longitudes, is at www.mantleplumes.org/CompleateHotspot.html.

[6] At least one recent model indicates that the mushroom shape may not always occur, but that doesn't mean it isn't common.

After the plume head comes the stem, which can continue to fuel eruptions for as long as the hotspot persists, possibly for many millions of years. But it's narrower than the head, so downstream from the flood basalts, the plume track should narrow to about the width of the stem, typically believed to be on the order of 100 kilometers. Again, that's what you see with the Yellowstone Hotspot, as the track crosses Idaho to its present location.

Once scientists started looking for locations where plume heads might have erupted, they found many. Two of the most famous are the Siberian Traps (one of the world's largest volcanic provinces) and the Deccan Traps (in India).[8] Similar regions can also be found under the sea, where they are called large igneous provinces or LIPs, and often mark the start of plume-related island chains.

How Hot is Hot?

Scientists are human. They love nifty theories that explain lots of seemingly unrelated things. So it's not surprising that the hotspot theory was popular. For years, nobody doubted it. And then, heresy. Shortly after its thirtieth anniversary, the theory came under attack.

I was at one of the scientific conferences where the battle was first joined. Unfortunately, the symposium title didn't say anything about fisticuffs, so I went to sessions that sounded more *Analog*-appropriate, like "Wet Mars," or "Astrobiology." A fellow journalist later told me that what I missed had all the flavor of a fifth-grade playground "debate."

"Yes, it is a mantle plume!"

"No, it isn't!!"

"Yes, it is!!!"

"No, it isn't!!!!"

Or words to that effect. The tone, undoubtedly, was civil (there were no actual fisticuffs), but the rebels were saying that one of the underlying theories of modern geology was hokum, and believers in a theory rarely take kindly to such suggestions the first time they hear them.

By 2004, the debate had gathered momentum but also become less polarized. Even hotspot believers were realizing that there were important questions to be addressed.

One has to do with how hot a plume needs to be before it can rise through the mantle and create an eruption. Until recently, nobody appears even to have asked. Then one of the leading hotspot opponents, Gillian R. Foulger of the University of Durham, England, calculated that for a mantle plume to rise properly, it must be at least 200 °C to 300 °C hotter than the surrounding rock.[9]

Foulger's calculation is interesting, but it's merely a tidbit of computer-modeling information until it's married to the geophysical study known as petrology.

Despite the similarity in words, petrology has nothing to do with petroleum. Rather, it's the study of how magmas crystallize into rocks.[10] Geologists have long known that different volcanoes produce subtly different lavas, thanks to differences in the temperature and chemical composition of the magmas that feed them. Petrology uses these differences either to look backward—from the rocks to the melt from which they were derived—or forward, from the melt to the rocks.

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[7] Basalt is a common volcanic rock. It's black, dense, and can flow for great distances.

[8] In volcanology, a "trap" is a type of lava.

[9] She appears to have done a good job with the calculation because I've never heard anyone argue with the result.

[10] The similarity comes from the fact that both words use the Greek root "petra," which means "rock."

When petrologists examine the rocks erupted from presumed hotspot volcanoes, the results are mixed. Data presented at the Fall 2004 meeting American Geophysical Union indicate that the lava from Hawaii's currently active Kilauea volcano probably comes from a source hot enough to be a mantle plume. In fact, petrologist Paul Asimow of California Institute of Technology went so far as to say that he had never seen a plausible model for a "cold" Hawaii.

But Iceland is a different matter. Isotope ratios indicate that its magma probably originates deep in the mantle (although not necessarily at the bottom), but the petrology shows it to be no more than 100 °C hotter than its surroundings. This means that while there's a hot lump beneath Iceland, it's not hot enough to be a plume. Petrological studies of older parts of Iceland indicate that the magma source may be growing cooler with time. If so, this might mean that what's beneath the island now is the remnant of a plume that's in the process of petering out. Or maybe it's something entirely different. At the moment, nobody knows for sure.

CAT-Scanning the Globe

Raffaella Montelli is part of a team from Princeton University that's trying to look directly at plumes, using a technique called "seismic tomography."

Tomography is simply imaging. When doctors do it to the human body, it's called computer-assisted tomography (CAT) and uses low-intensity X-rays to build three-dimensional images by scanning the body from multiple angles. Seismic tomography attempts to use seismic waves to do the same for the interior of the Earth.

When an earthquake occurs, seismic waves travel to seismometers all across the globe, moving not only through the crust, but also through the mantle. The hotter the rock, the slower they move. This means that once you know the exact time and place of any given earthquake, you can figure out how fast the signal traveled to each station. Add in a great many earthquakes from different epicenters and some heavy-duty computing, and you can start mapping the "slow" spots.

The problem is resolution. "We don't have a big choice of where there are earthquakes," says Norman H. Sleep of Stanford University (who was not part of Montelli's team). "So we have problems the doctor doesn't have." Also, he adds, "X-rays go in nice straight lines. With seismic waves it's like watching ocean waves veer after they hit a pier."

Montelli's group generated instant controversy when it published its first set of scans in *Science*, in early 2004.[11] Sleep said that looking at the images was about like using someone else's eyeglasses to watch a press conference or panel discussion. "You'd probably be able to tell that there are people up here," he said, "but you wouldn't be able to identify us. The tomography is like that—just tantalizing."

Foulger was less charitable. Very few seismologists believe that the tomographic images had enough resolution to actually show anything, she said. "I think the only people who put any faith in them are non-experts," she said, "or the people who do the models."[12]

In December 2004, Montelli was back. This time, her team expanded the analysis to include two types of seismic waves, called S-waves and P-waves, improving the resolution. What she had, though, was just as tantalizing as ever. In

[11] "Finite-frequency tomography reveals a variety of plumes in the mantle," *Science*, 303, 338-343, January 16, 2004.

some places, plumes appeared to descend all the way to the core. Others were decidedly odd: broken off, disconnected at the boundary between the upper and lower mantle, or bending sideways as though swaying under the influence of other currents.

Based on her new tomography, Montelli claimed to have found "well-resolved" plumes in six oceanic locations (Ascension Island, the Azores, the Canaries, Easter Island, Samoa, and Tahiti) plus "robust" findings in three others (Cape Verde, Cook Island, and Kerguelen Island in the South Pacific). More interestingly, she found an incipient plume—not yet reaching the surface—beneath the Coral Sea.

Other plumes, however, including Iceland, appeared to be confined to the upper or middle depths of the mantle, indicating that they may either have shallow sources or be tapering out.[13]

Skeptics are still not convinced that she is seeing actual plumes or plume fragments. That's because temperature isn't the only factor that can create seismic "slow" spots. Other possibilities include unusual rock composition, melting, and relatively high water content—any of which could occur beneath volcanically active areas, with or without a plume.

Bow Waves and Foraminifera

Without better tomography, the plume debate is branching in new directions as scientists seek innovative new ways to test the plume theory.

One test comes from Norman Sleep. Sleep, who was one of the early skeptics, set out to disprove the theory at its source: Hawaii. (Like many geophysicists, he figured that if Hawaii isn't a hotspot, nothing is.)

Sleep was intrigued by the fact that the seabed near Hawaii has a large bulge, about 1,000 meters high and 1,000 kilometers wide. Something similar shows up along the track of the putative Yellowstone Hotspot. Hotspot theory viewed these bulges as uplift zones, created as the crustal plates plow across the upwelling plumes. But the swells extend upstream of the hotspot—well ahead of where the plate is supposedly tracking across the plume. Sleep didn't believe a plume could create something that looked so much like a bow wave, so he modeled it, and got a surprise: his model predicted exactly the features seen in Hawaii and Yellowstone. This unexpected result convinced him that Hawaii and Yellowstone probably are the result of plumes. But, he is quick to point out, this doesn't mean that everything that's ever been catalogued as a hotspot really is one.

Another unusual test comes from Peter Clift: In another paper delivered at the Fall 2004 meeting of the American Geophysical Union, Clift explained that he is trying to test the plume theory by examining fossils in seabed sediments laid down on top of those undersea plateaus called LIPs.

If large igneous provinces really are created by plume heads, the eruptions that formed them should not only have flooded the seabed with lava, but also have uplifted it. All eruptions create uplift, but plume heads should produce unusually large amounts.

When an eruption ends, the seabed slowly subsides. Again, this is normal, but if the uplift was unusually large, the

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[12] Even non-experts weren't too thrilled. Several of my friends are science writers for major newspapers, and the talk in the pressroom was that you could see anything you wanted in the *Science* data. It's one thing to write about such things for a sophisticated *Analog* audience; it's another to try to condense it to 600 words for a general audience. There's a reason you never read about this over your morning cup of java!

[13] Or, as mentioned earlier, maybe the imaging simply cannot trace them through the boundary between the upper and lower mantle.

rate of subsidence should be unusually rapid.

Clift realized that he could test this using a class of fossils called foraminifera. These single-celled creatures have hard shells, which accumulate in marine deposits. Different types live at different depths, which means that cataloging the foraminifera in a sediment tells you the depth of the water in which it was formed. Doing this for each sediment layer gives you the LIP's initial depth and its rate of subsidence.

Unfortunately, the results are mixed. Some LIPs are subsiding quickly, as expected. Others are subsiding more quickly than the average ocean crust, but not quickly enough for the plume model. And still others are subsiding more *slowly* than the surrounding crust.

One explanation is that LIPs (or at least, some of them) don't represent plume heads. Another is that when a plume head hits the underside of the crust, part of it may stick there, crystallizing into buoyant rock (such as granite) that keeps the LIP from subsiding as expected.

Support for the latter interpretation comes from Yi-Gang Xu of the Chinese Academy of Sciences, who studied his country's Emeishan region, conventionally believed to have been created by a plume head.

Like Clift, Xu was looking for signs of ancient uplift, but since he was working on land, he couldn't rely on foraminifera. Instead, he hypothesized that the rising plume should have elevated the landscape in a dome-shaped formation before the lava broke through. Since plumes move slowly, this pre-eruption uplift should have persisted long enough to have been subject to erosion—and the higher the dome's center was, the more it should have eroded.

Luckily for Xu, the lava emerged through a layer of limestone that was probably uniformly thick. By measuring how much of the limestone remains in various places, it's therefore possible to map the areas of highest erosion, creating a crude contour map of the uplift. (Erosion would have continued after the eruption, but at that point, it would have been the lava, not the limestone, that was eroding.)

What Xu found precisely matched his hypothesis: the limestone is thinner at the center of the volcanic region than at the edges in a nice bull's-eye pattern that strongly indicates a central uplift. In addition, trace element analysis of the basalt itself indicated that the center was hotter than the edges—also consistent with a plume. Finally, seismic tomography indicates that the crust is 55 to 64 km thick in the volcanic zone's center, but only 35 km thick at its edges. This, Xu believes, reveals the remnants of the plume head sticking to the bottom of the crust—exactly what Clift needed to explain his anomalous LIPs.

Propagating Cracks

All of this research indicates that the plume theory is likely to withstand its challengers. It's hard to imagine that Hawaii isn't the result of something at least very much akin to a hotspot. The same would seem to apply to Olympus Mons.[14] At the same time, it is likely that when the dust settles, the theory will have had its wings clipped—possibly severely—and that many regions once viewed as hotspots (perhaps including Iceland) will prove to be something else.

Foulger's main complaint is that when everyone jumped on the plume bandwagon in the '70s and '80s, nobody really looked into alternative theories. Instead, the "great love affair with plumes" encouraged geologists to try to fit everything and anything into the theory, without asking whether there might be simpler explanations.

Foulger and her colleagues offer several alternatives that deserve to be studied in greater detail. One is that hotspot volcanism originates from exotic accidents of plate tectonics in which large chunks of seabed break off mid-plate and are drawn deep into the mantle. She also suggests that you could get flood basalts such as the Siberian Traps from "lithospheric delamination," which would occur if the bottom layer of the crust somehow broke free and allowed hot mantle rocks to fill the void.

Another theory is that the features we see as plume tracks might be created by "propagating cracks" that began at one point in the seafloor (or continent) and gradually unzipped over the course of millions of years.

James H. Natland of the University of Miami points out that the Pacific Ocean has 10,000 seamounts, most of which nobody has attempted to link to hotspots. Many of these can't possibly be the work of plumes because they lie in long ridges that erupted more or less simultaneously along their entire length.

Natland's belief is that when the Pacific Plate was younger (and smaller) it was subject to stresses that produced fissures that cracked over long distances, all at once. Later, different stresses began producing sequential eruptions that *look* like hotspots but aren't.

To spur further research, Foulger has helped create a website on mantle plumes: www.mantlepumes.org. Some of the material is technical, but much is accessible to the average reader.

From a science-fictional perspective, the hotspot controversy is a fascinating example of the scientific process at work. It could also make the subject for a truly ghastly movie. Imagine what would happen if a previously undetected plume head rose beneath Washington, D.C., or if terrorists found a way to create a new hotspot. As the plume rose, the entire East Coast would bulge upward. Port cities would become plateaus. Rocks would crack and lava would inundate everything.

It would be the greatest disaster movie of all time! Of course, in reality, you'd get thousands of years of warning (that "new" plume in the Coral Sea isn't going to erupt anytime soon), but in the realm of bad science fiction movies, when was the last time anyone worried much about minor technicalities like a few thousand years?

Meanwhile, actual scientists continue to wonder whether plumes are messengers from the Earth's core. If they are, *real* science fiction can raise the question of what they're trying to tell us.

So far we have no idea, but the one thing I'm sure of is that if I were investigating a planet like Mars, I'd love to have samples from Olympus Mons. And what an adventure it would be to climb it to collect them! ■

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[14] Many scientists also think there are hotspots on Venus, but if that's the case, the process works very differently than on Mars. Rather than forming recognizable volcanoes, the Venusian features are flat, circular plains that look suspiciously like impact craters. The only real problem with instantly classifying them as impact craters is that they're big—which means that they must date from the dawn of the Solar System. They're also very sharp and pristine, which means that if they really are that old, the surface of Venus must be nearly as erosion-free as the Moon's: a conclusion that many planetary scientists reject. For more on this topic, go to www.mantleplumes.org and click the link labeled "Planetary." This site also presents alternatives to the plume hypothesis for the formation of Olympus Mons.

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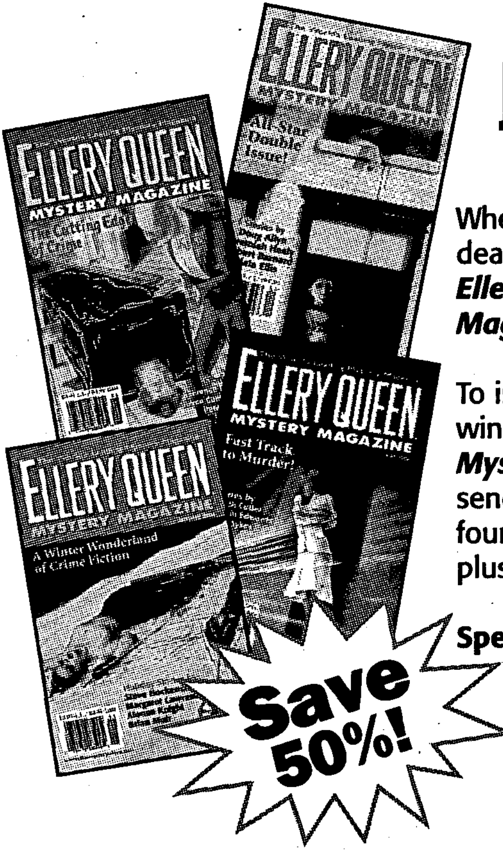

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Total Loss

James Hosek

Are you *sure* it can't come to this?

Pain was just beginning to seep through the medication. It was enough to bring Gary Carter back to consciousness. His eyes squinted against the bright lights and the realization that he was in a hospital emergency room brought back his memory. There had been an accident.

He remembered the yellow Ford Escape turning left right in front of him. He remembered seeing a look of panic on the woman's face, cell phone glued to the side of her head, as she saw Gary's '89 Geo Metro approaching. For some insane reason she stepped on her brakes! If she had just completed the turn she would have cleared the intersection and Gary would have missed her. As it was he had no choice but to slam on his own brakes. Wheels locked, he skidded across the drizzle-covered pavement into the passenger side of the SUV. He remembered the woman's scream over the crunching of metal.

Then he must have blacked out because the next thing he remembered was the paramedics and some firemen working to extract him from his car. Speckles of his own blood dotted the steering wheel and dashboard; the front end of his subcompact was crushed like a beer can on a cowboy's forehead at the end of happy hour.

He vaguely remembered the paramedics telling him his legs were going to hurt before he blacked out again. Now as he looked down at his legs it was obvious he had broken them both.

"You're awake, Mr. Carter," said a cheerful voice. Gary turned to see a young, dark-haired, unshaven face looking at his. A laminated ID card hanging around his neck over his green scrubs read "Dr. Morgan." He was looking at a flat screen monitor near the bed, on which some broken white sticks were visible on a black background. It took Gary a moment to realize they were his legs.

"That's me?" he asked.

"Afraid so. Still, I've seen worse. The surgeons should be able to fix you up. We've got you in some splints now to keep the bones from moving around, but once we get you to an OR they'll put on a few plates, some screws. Bad news is you'll never be able to clear airport security again." Morgan laughed but stopped short as he realized Gary wasn't appreciating the joke. "I'll, uh, check what's keeping the surgery consult," said Morgan. He smiled briefly before disappearing behind a curtain.

Gary leaned back and tried to take a deep breath. Soreness was beginning to creep into places he hadn't realized he'd hurt until just now. Kate was going to be pissed. Not only about the accident, but his wife had wanted him to trade in his old Metro for years. She was always worried that if he were in an accident he would get killed. He was in for a well deserved "I told you so."

"Mr. Carter?" asked a nervous voice. Gary was expecting another green scrubbed ER person but instead a small man was peering around the hanging curtain. The man's eyes darted around the hospital bed taking in the IVs, patient monitor, splints, and the radiographs still displayed on the video monitor. His manner reminded Gary of a scared ferret, unsure if it was safe to cross the room lest a cat intercept him from behind a potted plant.

"I'm him," answered Gary, "At least what's left of him."

"Oh my, this is quite out of the ordinary, I'm afraid," prefaced the ferret.

"And you are?" led Gary trying to figure out what this was all about.

"Ah, yes." He reached inside his jacket pocket and pulled out a card. He went to hand it to Gary. Unfortunately Gary's right hand was strapped to a board to keep his IV from pulling out and his left was covered with a large padded bandage with a pulse oximeter probe clipped over his middle finger. The ferret, undaunted, slipped the card between two fingers of Gary's right hand. "Bernard Crawford," he said, "Chicago Casualty. Your insurance company."

"Wow," realized Gary. "This *is* out of the ordinary. I haven't even called our insurance agent yet. You guys certainly give prompt service."

"Actually, the hospital called. I was in the building for another client and, uh, thought I'd take care of this right away, but I see you're, uh, still, uh, awake."

"Well, I didn't hit my head that hard and despite the pain medication, my legs are throbbing just enough to remind me what happened."

"Well, Mr. Carter," Crawford fidgeted, keeping his eyes off Gary, "I regret to inform you that based on the situation and damage incurred, we are determining your case to be a total loss. I'm very sorry."

"Well," realized Gary, "I pretty much figured that after seeing the damage myself. But even the police office agreed it was the other woman's fault."

"Well, I don't deal with fault, Mr. Carter—just the numbers, you see."

"Of course," said Gary. "I don't think I'll be driving for quite some time, so it might be better to settle up after I've had some time to recover. I know it was an older car, but it must be worth something."

"Car?" repeated Crawford, confusion creasing his forehead, which was starting to bead with sweat.

"Yes, my Geo. You said it was a total loss. I assume I might still get a thousand or so out of it. It was in pretty good shape despite the mileage."

"Oh, no, Mr. Carter. You have this all wrong. I'm from Chicago Casualty. I represent your major medical carrier. I'm the adjustor that has been assigned to assess your injuries and make recommendations regarding your care."

"I'm confused," said Gary. He tried to adjust his position in the bed and get a better look at the business card stuck between his fingers. The movement intensified the pain in his legs. He waited for the wave to pass and noticed Mr. Crawford becoming more uncomfortable, his fingers ringing the handle of his briefcase. "You did say that my case was a total loss?"

"Yes, I'm afraid so. I've been over the estimates three times. I'm afraid I can't justify the needed surgery and rehabilitation based on your life expectancy and the current value of your body parts."

Gary widened his eyes and stared at the insurance man.

Crawford continued. "We will cover five days of minimal hospitalization with adequate pain medication to keep you comfortable, but after that time, I'm afraid we must insist that you, well, stop receiving medical care and we be allowed to salvage the body for any useful parts to recoup our expenditures to this point."

"Expenditures?" asked Gary, "All they did was put in an IV and wrap my legs with these splints. This must be a joke. Is there a hidden camera around here?"

"No. No camera. But the expenses so far have been considerable, Mr. Carter," began Crawford. He set his briefcase on the side of the bed and opened the clasp. He pulled out a small tablet PC and tapped on the screen a few times. "Here it is," he announced with a smile on his face. He seemed much more comfortable now that he had some numbers to look at, rather than Gary's confused face.

Gary blinked a few times. This must all be a hallucination from the pain medication. This couldn't be happening. Insurance companies didn't treat people like cars and salvage them for parts. They had to pay for his care. That was why he and Kate had paid premiums every month. They had to fix him up. They were insured through Kate's work since Gary had his one-man computer programming business. Her company had changed insurance providers just a few months ago because of increasing costs, but that was nothing unusual. It had happened every few years. Sometimes it meant they had to change doctors, but this situation was insane.

They had gotten a packet of materials when the new insurance went into effect, but Gary had just filed it, never bothering to read the pages and pages of coverages and exclusions and fine print. He just assumed like every other health insurance policy, it would allow them to get whatever coverage they needed. He had heard of people being denied coverage for experimental treatments, but this was a couple of broken legs and some cuts.

Crawford began to read from his display, "Let's see . . . $5,435 for emergency field treatment at the scene of the accident." He chuckled to himself. "Talk about high liability insurance: those guys are covered to the gills." He saw Gary's serious expression, cleared his throat and continued, "$675 for transportation to the emergency room, $3,125 for diagnostic CT scans and radiographs, $8,432 for blood work, IV medications, consults and emergency care. Oh, and $422 for the splints—each, that is. Not including your five days minimal hospitalization, you're already at $18,511. We estimate your daily hospital bill to be around $3,300. That will be a total expenditure by our company of $35,011. So you see, Mr. Carter. Chicago Casualty has been quite generous in providing you with quality emergency treatment and care up to this point."

"But you're supposed to make me well."

"Well, that's not exactly what the policy says, Mr. Carter. Did you read the policy?"

"Nobody reads those things," argued Gary.

"We are only required to provide complete care in the event that recovery is imminent and full and the technology exists and is in common use. In other word, we can't do a head transplant until they become a codable procedure on the reimbursement form."

"But the doctor said they would be

able to repair my legs."

"Furthermore, Mr. Carter, if a patient shows no signs of recovering, such as in a persistent vegetative state or requiring heroic measures to sustain life, we may elect to discontinue medical care."

"Again," argued Gary, "I'm still here. Brain is fine. No machines keeping me alive . . ."

"I'm not finished, Mr. Carter," interrupted the ferret. He cleared his throat and returned to the legalese he was reading. "If at any time, the cost to sustain a patient's condition or to repair damage exceeds the patient's intrinsic value, or treatment would not result in recovery of the patient to a value exceeding the costs, the insurer may decline paying further medical costs and attempt to recover costs as obtainable from the removal and distribution of body parts from the corpse."

Crawford smiled, satisfied with the explanation and obviously confident that his assessment was correct.

"To quote a famous Monty Python line," answered Gary, "I'm not dead yet."

"For the purposes of your health insurance policy, Mr. Carter, you may as well be."

"You can't just kill me for parts."

"We wouldn't kill you. In fact it is better if the parts are harvested while the heart is still beating, for the major organs. Eyes and bones and cartilage and skin keep for quite some time."

"I must be dreaming," concluded Gary.

"To be sure, usually when we declare a patient a total loss, they are already brain dead. But since the brain adds no intrinsic value to your corpse according to my tables, technically you are worth more as parts than if we fix you up."

"Not to me," Gary retorted.

"Mr. Carter. The policy is clear."

"You can't get a doctor to do this, it's crazy."

"We have our own surgical technicians that do the harvesting."

"Don't I have to consent?"

"Not if you are a total loss. I admit the wording of the policy is not specific to your situation, but the way I interpret it we have a fiduciary responsibility to our shareholders and policyholders to cut our losses in your case and obtain as much salvage value as possible."

He tapped the screen again. "Now, considering your age and previous medical conditions, we can estimate values for certain organs and parts."

"I thought it was illegal to sell body parts," muttered Gary, not realizing he was arguing in favor of his body having no value.

"Oh, we don't sell them per se. There is an allowable harvest, storage, distribution, and transportation fee that our subsidiary, which does all that stuff, is allowed to charge. The organs are of course free to whoever needs them, but we are entitled to some reimbursement for our trouble."

"Of course," growled Gary,

"Heart and lungs come in at $2,568. Your previous history of smoking greatly reduces the value there."

"I quit ten years ago!"

"Still, the tables show a 70% reduction in value. Let's see . . . liver, $3,211. That could be more if you were an abstainer, but we don't get many of those these days. Kidneys top out at $4,299 each, not a bad deal. Intestines and pancreas fetch about $6,849. Corneas at $355 each. Skin is too old for much use, but bone banks can make use of the long bones. However, since you have broken several of them, we can only get about $1,200 for the whole lot. Cartilage is likely all shot as well, but that wouldn't add more than a few hundred. That brings us up to $23,136. Subtracting from the $35,011, that leaves $11,875 in the loss column. Now if you had been a client for more than five years we could have credited you some unused premium contribution, but in your case I really have no choice."

"You're going to deny me medical

care for $11,875? That's insane. I'll just put the balance on my credit card. Heck, a new car will cost me twice that."

Crawford placed his computer back in his briefcase. "That's not the way it works, Mr. Carter. If we did approve repairs, we're looking at almost two hundred thousand dollars in additional charges over the next year. I'm afraid we couldn't take the financial risk of continued insurance considering potential complications and your history of needing medical care."

"But this is the first time I've ever had to be in the hospital," Gary argued.

"Exactly, Mr. Carter. You've been with us for less than three months. At this point, without surgery and rehabilitation, you're costing us an extrapolated yearly cost of $140,044 on a premium of $3,567. Numbers don't lie, Mr. Carter. I'll see you in five days," he added as he left.

Gary slumped into the gurney. His wife was really going to let him have it now.

"I told you so," said Kate Carter with a touch of anger, but also relief that Gary was alive and appeared to be okay. Gary had been moved to a room on the third floor. The nurses were strangely subdued around him and he even felt a little neglected. Kate gently stroked his hair, avoiding the bandage on his forehead. "Are they going to have to operate?" she asked.

"There's a problem with the insurance," said Gary, still trying to think how to explain the situation to her. He still couldn't fully comprehend it himself.

"I told David not to switch. He thought it would save the company a few thousand bucks. Don't worry, we'll get it straightened out."

"I don't know about that," answered Gary.

"What do you mean?"

"They said that I was a total loss."

"You are a mess. Look at you: two broken legs, cuts and bruises. That car was a death trap. An accident waiting to happen."

"No, not a mess, a loss. They're writing me off. I'm too expensive."

"Your car?" she asked quizzically.

"No. It was the guy from the health insurance company. I'm a total loss. It would cost more to fix me than I'm worth, so they want to pull the plug and sell off my parts."

Kate's expression turned from confusion to amusement. "Very funny, Gary. Had me going for a second. Those pain medications aren't helping your sense of humor."

"It's not a joke," said Gary. "I wish it was."

Kate looked more closely at her husband. "Gary?"

"What are we going to do?" he asked.

"We'll pay whatever the insurance doesn't cover. How much could it be?"

"It's not a matter of cost, Kate. Apparently they are entitled to withhold medical expenses and recoup the losses."

"That can't be legal," realized Kate.

"It doesn't sound right to me either."

"Excuse me," interrupted a voice from the door. "Mr. Carter?"

"That's me," said Gary.

"I'm Dr. Wilson. I saw your chart at the station and since I'm the orthopedist on call, I thought I'd check in. Sorry I wasn't here sooner, no one paged me we had an emergency." The surgeon walked into the room as he flipped through pages in the chart. He was tall and young. His hair was black and wavy and his coat was immaculately white and pressed. A stethoscope hung around his neck. "Both legs, eh? Still, the radiologist's report is hopeful. We should be able to get you back up in six months or so."

"I thought . . ." started Gary.

Dr. Wilson looked up. His eyes widened to address his patient's concern.

"I thought the insurance had determined me a total loss," answered Gary.

"What?" spat Wilson. "That's ridiculous, you're not even in a coma. Let me check your insurance page." He flipped ahead, stopped, and squinted down at the page. Flipped back, then forward again. "I've never heard of this."

"Of what?" asked Kate.

"Well, on rare occasions, people's insurance coverage runs out or the doctors and insurance company agree that further treatment is pointless, but your husband here isn't in that position. It must be a mistake."

"That's what I thought, but the insurance guy went over the numbers. He seemed so analytical."

"Can't you just go ahead and fix him? Doesn't the hospital have the ability to help people without insurance?"

"Well, if you had no insurance at all, yes, we'd be obligated to provide care and repair the fractures, but you do have insurance and the insurance company has the option to cut their losses."

"That can't be right," moaned Kate. "Can't we just cancel the insurance? It's not like we couldn't pay for it ourselves over time."

"The matter is out of my hands, I'm afraid," pointed out the surgeon. "When it comes to financial matters, the hospital administrators don't like to get into battles with insurance."

"So they're just going to cut me up for parts?" asked Gary.

"Once they stop paying for care in five days, you're not going to feel much like living, especially as the bones start to heal back together in abnormal positions. Heck, you might get lucky and have a bone marrow embolism and it will be over like that."

"You're a doctor," said Kate in shock. "How can you let this happen?"

"If there was a way to do this, I would," said Dr. Wilson. "But my hands are tied. If I touch your husband I will not only be fired, but every insurance company in the country'd blacklist me. Worse yet, I can't even bill for this consultation." He closed the file and walked out of the room.

"This is insane," muttered Kate.

"That's what I've been saying," agreed Gary.

Kate turned and watched Dr. Wilson return Gary's chart to the rack at the nurses' station. After he walked down the hall to the elevators, she slipped over to the nurses' station and lifted the folder, tucking it against her chest as she scurried back into the room. She started flipping through the pages until she found the section she was looking for.

"What are you doing?" asked Gary.

"All these insurance policies have loopholes and exceptions and twisted procedures and rules. Maybe there is a way to beat them at their own game." She pointed at the record. "Here is the insurance page. You look this over. I'm going home to get our copy of the policy. We'll figure out something."

"You think we can beat this 33insurance company at their own game? Maybe we need to call the police or insurance board or something."

"If we can't find anything we'll have to, but maybe we can find something that will make them reclassify you from a total loss," suggested Kate.

"Okay," Gary said. "It beats being chopped up for parts."

Gary and Kate spent the evening reading and rereading the policy. The language was so legalistic and twisted it took them several times through to adjust their thinking to match that of those who had written it. Kate was surprised to find that the policy only covered families for the first 2.2 kids. Their formula for determining care for 0.2 of a kid was pretty creative.

Gary found it useful to look at the policy as a computer program. No matter how well written, there had to be bugs. His scrutinizing finally paid off. In the case of the policy, the bug was a loophole—actually, several loopholes. Any by themselves were not a solution, but when he and Kate put them together, a plan began to formulate. They started work that night and soon had generated a couple of documents written on hospital stationery. When Kate was satisfied with their work, she headed home to type them up and make a quick stop at the bank before returning in the morning.

When she returned they had Dr. Wilson paged by a wary nurse. A few minutes later he was knocking at Gary's door.

"When can you do the surgery on my legs?" Gary asked.

"As I explained to you before, Mr. Carter, I can't get involved."

"Oh, but you can," explained Kate. They explained their findings in the policy and Dr. Wilson found himself nodding in agreement.

"Very clever," he concluded. "They have no choice when you put it like that. They worded their policy *too* well, it seems," said Dr. Wilson. "I should be able to book an OR for this afternoon." He picked up Gary's chart and made a few notations.

"Oh, and Dr. Wilson, be sure to use the very best stuff."

"Only the top-of-the-line for you, Mr. Carter," answered the doctor.

Later in the morning a nurse came in with some tablets for Gary to swallow. "They'll take the edge off for the anesthesia. They shouldn't knock you out, but you'll get a good buzz," she warned.

"The buzzier the better," said Gary.

A few minutes after that Crawford's confused face appeared at Gary's door. Gary was beginning to feel the effects of the medication. The pain in his legs was now just a constant ache.

"Mr. Carter, um, I'm afraid there's been some sort of misunderstanding," he voice quavered with bewilderment.

"Mr. Crawford, come on in," Gary invited. "I've actually been expecting you. I didn't think it would take long. You guys probably saw something pop up on my hospital bill and realized what was happening."

"Well, yes. The lorazepam tablets are typically given to preoperative patients, of whom you are not."

"Oh, but Mr. Crawford, I *am* a preoperative patient. In an hour I will be an operative patient, and later tonight I will be a post-operative patient. Chicago Casualty will be sparing no expense at fixing me up. Titanium alloy bone plates and screws, top-quality inpatient and outpatient physical therapy, the best pain medications, even a private room with cable and all the NFL games during my recovery. What's even better is that you'll owe me $12,900 at the end of the day. What a deal."

Crawford found a slight chuckle within himself. It came out like a stuttering turtle. "We don't even do that for patients who qualify for coverage, why would we do it for a 'total loss?'"

Just then, Dr. Wilson entered the room. "Ah, Mr. Carter, I see you're nice and relaxed for surgery." He flipped through Gary's chart, nodding with approval.

"There will be no surgery," interjected Crawford. "I represent his insurance company and we have denied his claim. This patient is a total loss."

"Indeed he is," noted Dr. Wilson. "Everything seems to be in order with regard to that," he said thumbing to the appropriate section of the record. "Here it is, approved by a Mr. Bernard Crawford. That's you, I believe."

"Of course it is. Now cancel this man's surgery or I will be forced to call the hospital administrator and possibly deny any payment on this patient's bill."

"Can't do that," said Dr. Wilson. "You can call the administrator, his extension is 1874. But I'm afraid he's signed off on this." Wilson and the Carters had their turn at a laugh.

Crawford couldn't understand what was going on. He grabbed the chart from Wilson's hand and read over the insurance form. Everything was as it was the day before. Carter was a total loss.

He was entitled to four more days of palliative care, then harvesting. It might seem cruel or unusual, but it was perfectly legal. The insurance company was entitled to recover its losses where it could.

"Mr. Carter, you are entitled to four more days of care, then that's it. We are entitled to any and all salvageable body parts for distribution at our discretion. Now I don't know what you think you are pulling, but this must stop now. As it is I'm going to have a tough time with the lorazepam tablets going through. Since they weren't pre-authorized, the hospital may have to swallow those, so to speak."

"Mr. Crawford, you really must read the policy more carefully. I'm sure you have it memorized paragraph by paragraph, but perhaps you're too close to see certain . . . subtleties. For once, the insurance company is going to get screwed and the best part is you did it to yourselves."

"What are you talking about?"

"It's your total loss provision, cleverly buried in a section on exclusions for special diets not related to metabolic or hormonal disorders prescribed by a clinical nutritionist under FDA livestock feeding guidelines. You guys must get a laugh when you write these things."

"The provision is clear," commented Crawford.

"Exactly," agreed Gary. "I'm not disputing the total loss. That's where your problem is."

"My problem?"

"Yes, the policy expects everyone to dispute the total loss. Who wouldn't? After all, we are talking about someone dying. Granted, most people covered under this provision are going to die anyway, but you never took into account specifically a patient who was still conscious."

"I still don't see what you are getting at."

"I waived my five days in the hospital," said Gary.

"Waived them? Why would you do that?"

"I bet you guys thought it was pretty compassionate to include the five-day waiting period. Pay out a little for a few days, then reap a windfall with body harvesting. In fact, your little subsidiary that harvests parts and distributes them, for what are undeniably reasonable fees, doesn't even get notified until the day before harvest. Why should they? They have other things to do."

"So they harvest you early. I don't care if you give up the four days."

"Oh, you should. You see, since I won't be using my body for those four days, I'm entitled to compensation equal to but no greater than the daily expenses for unused days. That is, over and above my deductible of three hundred dollars."

Crawford had his computer out and was scanning the screen nervously. "No one has ever waived their time. Even people with dying relatives never waive the five days. It's crazy."

"It's in the policy. And you yourself quoted me the cost of $3,300 a day. At four days left, minus $300 . . ."

Crawford nodded. "Twelve thousand nine hundred dollars," his voice cracked. He rubbed his neck around his collar, then pulled out a handkerchief to dab at his sweating brow. "Claims is not going to like this."

"And I'm entitled to that check by the end of business today," Gary pointed out. "Give it to my wife. I'll be otherwise occupied."

"Yes, but even so, we don't have to pay for your injuries."

"Absolutely not," agreed Gary. "I never said you did."

"Then why are you having surgery to fix your broken legs?"

"And repair my lacerations. They say the plastic surgeon guy here is excellent."

"It's not authorized."

"Mr. Crawford, again you are too close to the policy. Step back a moment. I am not your patient now. I am your property. Well, was your property, until you sold the distribution rights to my parts."

"We did no such thing."

"I'm afraid you did. You had to. You only had six hours after I signed the waiver. Since your regular distributor didn't seem interested, another party bought them."

"Another party?"

"Yes."

"Who?"

"Me."

"You?"

"Me. I got them pretty cheap too." Gary waved Crawford closer and whispered. "Don't let it get around, but I paid a *dollar* for the whole lot."

"What?"

"It turned out to be the high bid. Imagine that."

"You can't bid on yourself."

"Nothing in the policy says I can't. In fact, the policy assumes that all tissues for distribution will go to your preferred distributor, but by law, you have to include language delineating an open bidding process. Of course, without having to actually notify anyone, it's up to the other parties to sniff out available bodies before the bidding closes."

Once again Crawford scanned his computer. Gary reached for an envelope by his bedside. He handed it to Crawford who took it absently. "What's this?"

"Your certified check for one dollar," answered Gary.

"I can't accept this," said Crawford. He placed the envelope back on the bedside table.

"You just did," pointed out Dr. Wilson. "I'm a witness."

Crawford glanced at the envelope, then returned his stare to the computer screen. He swallow hard. This couldn't be happening. Insured people didn't manipulate wording in the policy. It was the insurer's prerogative to do that. But they still hadn't explained everything.

"Assuming you did waive the five days, and properly bid on the distribution rights, I still don't see how we have to pay for your surgeries and recovery. It will cost us a fortune. It just isn't included in any coverage."

"Again, Mr. Crawford, you're thinking like a weasel trying to steal an egg from under a chicken. You're not paying under the policy. In fact, the policy specifically forbids any further treatment once the five days are waived."

"So you admit that you can't have the surgery."

"Absolutely," smiled Gary, "However . . ."

"There are no howevers, Mr. Carter." Crawford was sure the twisted road through the health insurance policy ended there.

". . . However," continued Gary, "under the organ donation section, it specifically states that Chicago Casualty will do all that it can to insure the organs provided are suitable for use and free from defects or damage prior to distribution. Since my bones and skin are included in the list you provided for me the other day, you have to make sure they are in good condition before I can take possession. As I read the policy, that means the bones must be fixed and the skin repaired."

"That's not the intention of the policy," argued Crawford.

"It's not the intention of the policy to have otherwise healthy people harvested for organs when they can be fixed. You are the one who is trying to stretch the wording to save your company some money. Now you are stuck with the whole bill and you owe me almost $13,000."

"This is impossible," said Crawford, his face and mouth twitching with frustration, sweat starting to bead up on his forehead.

"I remember thinking that exact same thing yesterday," mused Gary. "The hospital billing department has copies of all the appropriate policy sections, my waiver, and my bid for distribution rights. Oh, and since this is not a patient coverage, they're going to want to be paid right away, instead of waiting four to six months like you usually make them do."

There was a knock at the door. "Carter. Three-Oh-Seven. Got a date in OR six," stated a tall orderly accompanied by a stocky nurse.

Gary raised his arm, IV tube and all. "That's me."

"We just wheel the whole bed," said the nurse. "Just relax, Mr. Carter."

"So long, Mr. Crawford, nice doing business with you," said Gary as he lay back smiling.

"Wait," interrupted Crawford, "I'll get the total loss waived. We'll pay for the standard coverage," he suggested. He was thinking of all the extra money that Chicago Casualty was going to have to pay. The Carters had outlined their case as well as any insurance adjustor.

"Hmm," thought Gary for a moment. "Naw, I'll go with what I've got now. Sorry, Mr. Crawford."

Crawford watched the bed as it was wheeled to the elevators. He returned to his tablet PC, tapping and scratching at the screen in a panic. It couldn't be right. This was preposterous. This wasn't supposed to happen.

Dr. Wilson started to leave as well, but noticed the envelope on the bedside table. He picked it up and handed it back to Bernard Crawford. The confused adjustor looked at the doctor with wide eyes, his mouth partway open. "You don't want to forget this," Wilson said, handing the one-dollar check into Crawford's trembling fingers. "We wouldn't want the whole thing to be a total loss now, would we?" ■

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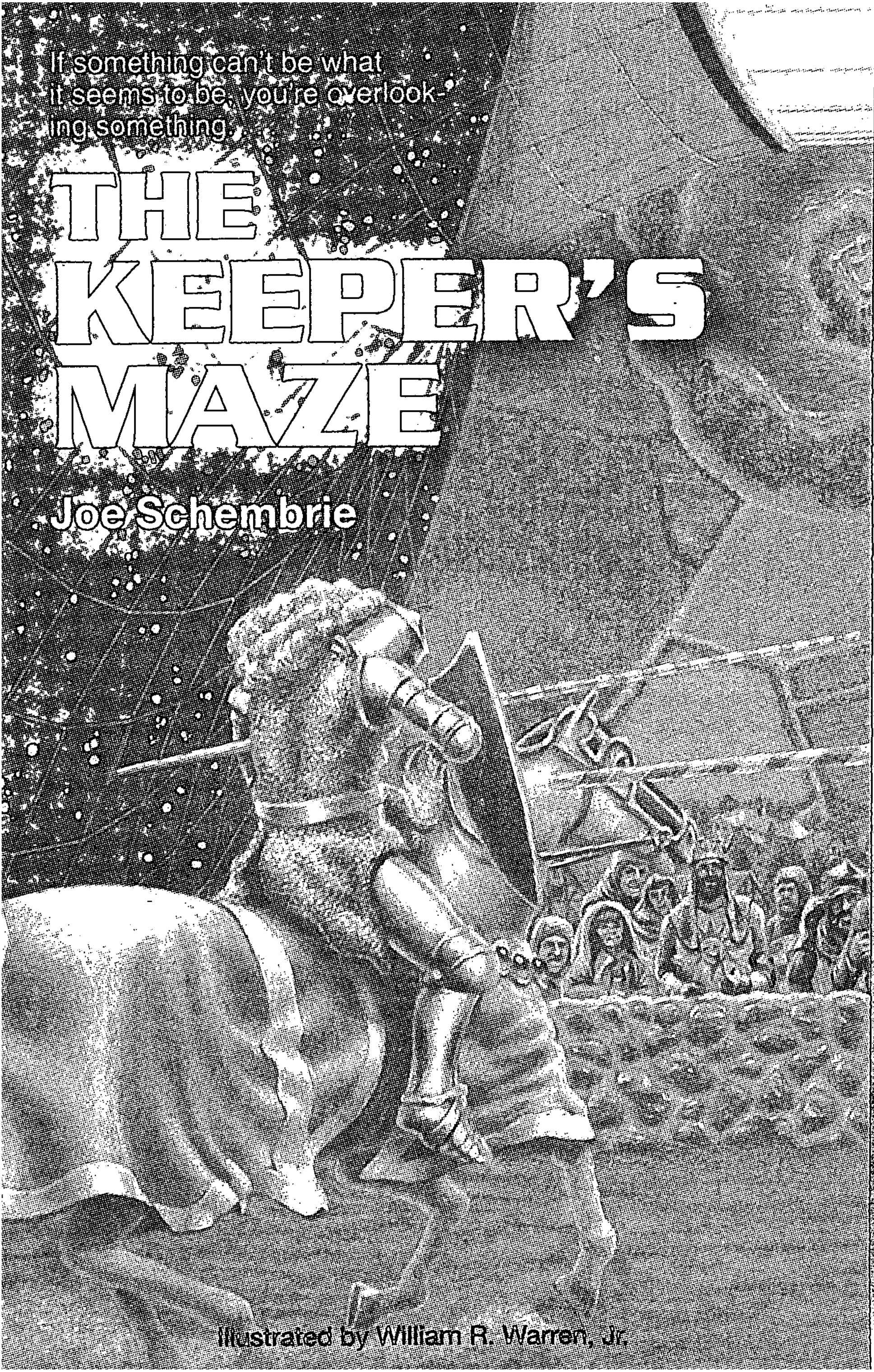
THE KEEPER'S MAZE

Joe Schembrie



Illustrated by William R. Warren, Jr.

Dressed in a rented monk's robe, Joshua Wang emerged from the forest trail. Ahead, beneath the revolving canopy of stars and a two-kilometer arch, torch lights flickered upon the stone walls of a castle. On the field beside the walls, a pair of armored knights faced on mounted chargers, raised lances, and clashed. The throng of tourists gasped as one of the knights tilted off his horse.

At the castle drawbridge, guards crossed their pikes.

"Joshua Wang of Raven Space Salvage and Recovery, to see Emil Hamilton."

"I'll see if his Lordship is available," said a guard.

After waiting within the castle courtyard, Joshua was greeted by a young woman bearing a quill, parchments, and a tightly strung bodice.

"Lord Hamilton will receive you," she said, her English accent as deep as the cut of her period dress. "Prithee come."

He was escorted to a high-raftered chamber adorned with tapestries of knights slaying dragons and one another with equal enthusiasm. It was the only room he'd seen since the docking port that had an undisguised computer.

"Joshua, so grand to meet you!" the lone occupant by the stuffed boar's head bellowed with a cavernous smile. He was costumed as a dead ringer for Henry VIII. "I'm Emil Hamilton." Shaking hands vigorously, he gestured toward the balcony. "What do you think of my little spinning world?"

Joshua took a moment to parse the words. Coming from the forest, he had lapsed into thinking he was on an actual planet. In reality, they were over a quarter-billion kilometers from Earth, and the forest, field, and castle were all inside an artificial space habitat—an "asterie," a rotating ring two kilometers in diameter floating in an independent orbit within the Asteroid Belt.

"Scarborough?" Joshua nodded. "Nice."

"A man of few words." Hamilton took a cigar from a jeweled humidor. "Your references mentioned that."

They sank into fur-lined chairs before the fireplace and exchanged the small talk typical for the high-context business culture of the Belt. It wasn't long, however, until Hamilton's features lost their joviality.

Hamilton tossed a file folder. "Tell me what you see."

Joshua opened the cover to a photograph of a snow-white horse in rampant pose. From the horse's head protruded a horn, about a meter long, slender and sharp as a rapier.

"A unicorn," Joshua said. If his crew had traveled a megaklick from New Seattle for a *joke* . . . .

"Plantagenet Line." Hamilton held his cigar to the fireplace and puffed. "Finest breed of unicorn ever to be genetically engineered. It would be a tremendous draw for this resort. It was to be delivered weeks ago, and I want you to pick it up."

"Where is it?"

"Next item."

Joshua flipped to the next sheet in the folder, a photo of an undistinguished crescent among stars.

"An asterie?"

"Daedalus, the zoological development asterie of Daedalus Genetics Limited. It's currently passing within two million kilometers of Scarborough." Hamilton smacked an armrest. "May as well be beyond Jupiter, for all the cooperation I've received!"

"You want *Raven* to go there and bring you a unicorn."

"Thirty thousand Ceresian credits."

Joshua calmed his heartbeat. "That's a bit much for a short cargo run."

"There's somewhat of a complication. The asterie personnel evacuated and left no forwarding address. You'll board on your own initiative."

"You mean, board without permission. There's a seven-year waiting—"

"Look, I don't want you to salvage the asterie. I just want my unicorn!"

"Still, there are laws—"

"Joshua, you've been in the Belt long enough to know that every asterie is a sovereign entity. My legal point is that they're illegally holding property I've paid for."

"I see."

"I was told you have the requisite skills for cracking abandoned eggs such as this, which is why I'm engaging a salvager rather than a freighter skipper. So is there an insurmountable objection?"

Hamilton billowed smoke within inches of Joshua's face. Joshua buried his frown as he studied the photo of the unicorn.

"I can't see us lassoing this thing."

"Let me make it easy. Just go to the main lab and get me the genetic materials that I ordered, so that I can grow my own. A few embryo packs, and you're done."

"What about the keeper? Won't it repel unauthorized boarders?"

"The asterie's sole defense was a sentinel ship. The personnel departed aboard it. The asterie is now toothless. And the keeper is one of those doddering traditional types that can't hurt a fly. Plus, it's daft."

"Daft?"

Hamilton chuckled. "Issuing threats about a maze or some such nonsense."

"A *maze*?"

"I don't know anything beyond that. Contact it yourself."

Outside and below, metal crashed with metal. A thousand voices gasped. Joshua riffled the folder's pages. And he thought: thirty thousand credits.

"We'll need ten percent up front. For fuel and mission consumables."

"You're accepting?"

"I'll have to consult my crew."

At the mooring position fifty kilometers from Scarborough, the control room camera swiveled to greet *Raven's* returning captain and the voice of the ship's computer emanated from a speaker grid: "Welcome home, Joshua."

"Thank you, Hermes." Garbed once more in twenty-first-century tee shirt and slacks, Joshua slipped into the navigator-pilot's chair. "All's well, I trust."

"All ship's systems are well," Hermes replied. "However, Lucas has stated that he is not well."

Both Ann Striker and Lucas Chulaski, Joshua's fellow crewmates aboard *Raven*, were present in the control room. Ann was pressing a cold compress to Lucas' head. Lucas half-opened an eye and moaned.

"My anti-addiction implant," Lucas said. "It's too sensitive. We go to a tavern, I pour a flagon of mead and toast the green, green, lice-infested hills of Earth—and pow! A hangover with just one sip!"

"See what I got?" Ann said. "Reena will love this!"

She unribboned a box and unwrapped a crystalline figurine of a unicorn.

"Gift shop was bursting with unicorns," Lucas said. "Glass, gold, chocolate. It's unicorn mania over there."

"Yes," Joshua said. "There's a reason."

He briefed them.

Lucas massaged his temples. "Joshua, is there an honest asterie developer in the Belt? Especially this guy. The rumor over there is that he strong-armed the creator of Scarborough to sell."

"I know it's only a themeworld," Ann said. "But I wonder about a person who has flunkies calling him 'lord.'"

Lucas nodded. "Or baron or whatever. That whole serfdom scene."

"On the other hand," Ann continued, "I'd love to see a live unicorn!"

"What we need to see," Joshua said, "is the mythical, black-bottomed income statement. Which is why we're even considering a job like this."

While Joshua concocted their ritual bull-session espressos, a subdued Lucas linked to Asternet and contacted Ceres Legal, whose AI counsel sifted through the interlocking maze of treaties and concordats that served the Asteroid Belt in lieu of a central government.

"Ninety-five percent precedent that arbitrage courts will find in our favor should we board without permission," Lucas read from the screen.

"Forced entry still bothers me," Ann said.

"This operation will be nonviolent and nondestructive," Joshua replied. "If we have to do more than drill a lock, we'll withdraw."

"Aye, Captain," Lucas said. "About this maze business—"

"It's time we went to the source."

Joshua held the coordinates sheet to the control room camera. Hermes traded protocols over the standard one-hundred-gigahertz tightbeam communications link, establishing plain-text as the baseline message format.

Calling Asterie Daedalus, Lucas typed. This is Spaceship *Raven*. Request contact with your master.

Lucas's screen flashed the response, thirteen seconds of lightlag later: Spaceship *Raven*, this is the keeper of Daedalus. Asterie personel are not available at this time.

"Ask what happened to them," Joshua said.

Lucas typed. The keeper responded: Personel are not available at this time.

"Request permission to board and lend assistance."

Permission to board is denied.

"If we attempt to board, do you threaten harm?"

I have no weapons. I am programmed not to harm. However, those who enter the maze will never escape.

"Tell us about the maze."

No further information will be provided. Those who enter the maze will never escape.

"Lucas," Joshua said. "You think the keeper's on the level?"

"Keeper artificial intelligences are programmed to maintain the stability of asterie environments," Lucas replied. "Usually, they're specifically programmed not to practice deception. And if it could lie, why not threaten to shoot us?"

"So what is this maze?" Ann asked.

"Well," Lucas said, "the thought processes of keeper-type AIs are concrete, not metaphorical. So, presumably, it's a physical maze."

"It's actually rearranged its interior?"

"Unusual, but conceivable. The maintenance robots could do the remodeling."

"Lucas, it makes no sense! Aren't computers supposed to be logical?"

"Ann, being logical is different than making sense. Here's how I think it works. To start, it's an older, tradition-minded keeper, with inviolable ethical parameters—"

"Asimov's Three Laws," said Joshua, who liked to read historical science fiction.

"Uh, yes," Lucas said. "At any rate, its ethics are carved, so to speak, into the bedrock of its operating system. So it can't harm us, by action or inaction."

"And the maze?" Ann asked.

"Perhaps, while they were evacuating, the asterie personnel ordered the keeper to protect the asterie from intruders at all costs. So the keeper had to develop a non-lethal way to comply."

"A maze," Ann said. "I'll bet it's really a trap."

"Getting trapped aboard a deserted asterie could be lethal," Joshua said. "Which violates its ethical programming. Let's point that out."

The delay was longer than thirteen seconds.

To answer your objection, the maze is not a trap. A way of excape is always available. However, it is impossible to escape from the maze. Pause. No further information will be provided.

"If it was human," Ann said, "it would know it's only making us curious."

"I realize this is the Belt and anything can happen," Lucas said. "But who's afraid of a maze?"

They discussed a few minutes more, then drained their espressos and voted.

* * *

Two weeks and two million kilometers later, the ship collapsed its plasma bubble and, with milligee deceleration, parked fifty kilometers from the asterie.

Daedalus was an unburnished ball with no major protrusions or cuts save a hangar at one end of the spin axis and a rocket exhaust nozzle at the other. The rim rotation calculated to half a gee simulated gravity on the five-hundred-meter equatorial radius.

They observed the telescopic view on the control room's main screen.

"We call asteries 'eggs,'" Ann said. "But this actually looks like one."

"A common design for a space habitat," Joshua said. "Use a solar mirror to heat a ball of metal to molten, inflate like a balloon, cool to solid. Very simple, very cheap."

"Very claustrophobic," Ann said.

"*Raven's* hull sensors are tasting radioactive isotopes," Lucas said, reading a chart-laden side display. "Traces of krypton-85 and iodine-131."

"Typical of a fission reactor," Joshua said.

"How do you know that?"

"I was an engineering mate, long ago. Some days I wish I hadn't made the career change." Joshua stared at a bar graph on Lucas's screen. "The reactor must have been operating recently if the iodine-131 is still significant. The half-life is only eight days."

"The reactor isn't being used for propulsion," Ann said. "The asterie hasn't moved in two weeks."

"It's being used for internal power requirements," Joshua said. He nodded to the image on the screen. "You'll notice, no solar mirrors or panels."

"A reactor presents a smaller radar cross-section," Lucas said.

"A nuke is a lot more expensive than solar arrays," Ann said. "They're going out of their way to keep a low profile."

"Gazing as I am upon this orb of mystery," Lucas said, "I once more ponder our client's true motives."

"The answers are inside," Joshua said. "If there are any."

They dispatched Hermes Junior and watched its telemetry on the control room main screen. The robot surveyed the asterie's shell at one hundred meters. The camera relayed images of dull, smooth metal, and of tiny, highly radioactive vent ports. It soon became apparent that the only humanly or robotly possible entry was through the hangar.

Synchronizing with the hangar rotation, the barrel-like scout robot alighted on the deck, and rolled past the vacant docking berths to the main personnel airlock. The opening mechanism was a single button.

Junior erected a transmission repeater. Elevating an appendage, it pressed the airlock button. The door slid open. The robot cycled inside.

"Too easy," Joshua said quietly. "For thirty thousand credits, that is."

"Normal pressure and oxygen ratio," Ann said, scanning her data-feed screen. "Radiation in the safe zone, biofilters clean. Temperature sixteen centigrade—sweater-wearing weather."

Lucas cocked an eyebrow. "How does the unicorn get the sweater over its head?"

Ann grinned and swatted his shoulder.

"Carry on, Junior," Joshua said.

"Right-oh, Joshua," Hermes Junior said.

Unspooling a fiber optics cable after itself, the robot rolled deeper within the asterie. Its camera eyes relayed empty passages and barren compartments. Socks and shirts lay scattered haphazardly on the cabin floors.

"They were in a hurry to leave," Lucas said.

"What are *those*?" Ann demanded.

Lucas flipped on Junior's head lamp. Inside a dark room, a dozen pairs of yellow dots gleamed from floor level. Brown furry shapes the size of shoes scurried into the shadows. Over the speakers came squeaks and squeals.

"Rats!" Ann said.

"We've seen rats in abandoned asteries before," Lucas replied.

"These look different. Can you get closer?"

Lucas drove Junior over the threshold, but just then a lamp crashed from a desktop, missing the robot by centimeters.

"We're not here for rats," Joshua said.

Junior exited the cabin and continued down the passage. A rat waddled across an intersection, and more eyes blinked from darkened rooms.

"A regular infestation," Ann said.

"In a way it's comforting," Lucas said.

They stared at him.

"Regarding the maze," he said. "If the rats solved the maze, how hard can it be?"

Junior passed an elevator and, mindful of its trailing cable, trundled down a ramp instead. Then the walls changed, becoming uniform and smooth. The robot entered room after room filled with containers. Most of the containers were refrigerator and freezer units, plugged into wall outlets.

"They carry a lot of cargo," Lucas said.

"A zoological asterie would," Ann said. "As it orbits through the Belt, it passes asteries in neighboring orbits, and merchandise is transferred back and forth."

"Like a mobile distribution center," Joshua said. "Or flying warehouse."

With Joshua wearing the teleoperations glove, Junior undid latches, twisted handles, and pushed open sliding doors. Each doorway led to another compartment, without intervening passages. Despite the sameness of the walls, the compartments followed a seemingly random geometry and were seldom the same size and shape.

"Maybe this is the maze," Ann said. "I'm confused already!"

"Hermes will remember the way out," Lucas said. "But how are we going to find the lab? The compartments aren't labeled. How did the people who worked here find their way around?"

Joshua said: "The keeper must have directed—"

"Whoa!" Lucas said.

The wall in front of Junior bore coin-sized punctures, set in a curving line.

"Automatic rifle fire," Joshua said.

Lucas panned the camera. The other walls were similarly strafed.

"An all-out battle," Lucas said. "But why? Pirates? Mutiny?"

"Hey, guys," Ann said. "Does it seem like there's more rats?"

Lucas panned again. From each corner, behind every container, a pair of beady yellow eyes blinked. Joshua had seen plenty of rats aboard derelicts. Yet these were different. They were larger, bulkier, and their fixed stares prickled his neck hairs.

Just then, the screen went blank. Lucas barked at the control room camera: "Hermes, report!"

"Scout telemetry lost," Hermes replied. "Comm cable break indicated."

Joshua stroked his chin. "Let's contact the keeper."

"I'll get voice this time," Lucas said.

A moment of frenetic typing later, and a male-sounding voice said over the control room speakers, "This is the keeper of Daedalus."

The voice was calm, almost deferential. Joshua realized he had assumed from the capital letters of the plain-text transmission that the keeper had been shouting.

"Keeper," Joshua said. "I am Joshua. I am captain of the spaceship *Raven*."

"Hello, Joshua."

"Keeper, what have you done to our scout robot?"

"I have not harmed your property, Joshua."

"Then what happened to it?"

"Nothing has happened to it, Joshua. It is unharmed."

"Then what caused its communications cable to break?"

"The cable was broken by the maze."

"The maze? How?"

"No further information will be provided. However, there is no escape from—"

Joshua disconnected. He zoomed the telescopic view on the main screen. For a long moment, he gazed at the asterie's revolving, uninformative shell.

"Our turn now," he said.

"Nonviolent and nondestructive," Ann said, watching Joshua load a snub-nosed automatic rifle into each of their personal carrybags.

"We won't start trouble," Joshua replied.

"Those bullet holes." Ann shuddered. "I'm a single mom! If I didn't need the money so badly—"

"Are you staying here?"

A long pause. "No. Of course not."

Lucas opened the explosives locker and loaded his carrybag with his handmade charge packs.

"Plan on blasting your way through the maze?" Ann asked.

"It's one solution," Lucas replied. From a strongbox within the locker, he removed several candy bars in red-and-white foil wrappers. Meeting their gazes, he said, "Hey, supposing we do get trapped!"

Once fully suited, they boarded the skiff, broke from the de-spun ship, and flitted toward the asterie.

"Joshua," Hermes said over the radio. "The keeper of Daedalus is calling for you."

"Something about no escape from the maze?"

"Yes, Joshua."

"Let me know if it has something else to say."

Minutes of crossing open space, and the skiff alighted in the hangar. They dismounted and, with Joshua leading in a show of decisiveness that he didn't quite feel, they cycled through the airlock.

The inner door slid open. Their helmet lamp beams revealed an unlit compartment whose rows of lockers and shelves burgeoned with space suits and helmets and other outside-the-hull equipment.

"Pretty pricey stuff to abandon," Lucas said. "And in good condition. Too bad we're not here to salvage. Our financial problems would be solved with this one room."

"Keep your suits on," Joshua said. "They may have evacuated because of a plague."

"I doubt it," Ann said. "If they were doing macroscopic genetic engineering here, they wouldn't mess with viruses. It would endanger breeding stocks."

"I hope you're right, Ann."

Lucas scrunched his mouth at his computer tablet, which was connected to a Geiger-Müller-style radiation detector on his belt. "Radiation is registering safe levels. No alpha or beta, very low gamma."

"Keep monitoring," Joshua said. "A reactor problem is another possible reason for evacuation."

Lucas attached his spool of fiber optics cable to the same repeater that Junior had erected on the interior side of the airlock. He unspooled his cable behind them as they progressed down the passage, their helmet lamp beams bobbing spots upon the walls.

They managed only a few steps when the overhead lights gleamed on.

"It's making us welcome," Ann said. "Even though it wants us to leave."

"Don't human hosts show courtesy toward their unwanted guests?" Lucas asked.

Ahead lay a brightly illuminated, spotlessly clean ship's corridor. Joshua listened with his suit's external microphones at maximum. The lights hummed and the ventilators purred. Far off came a creak.

"Let's go," he said.

Switching off their helmet lamps, they followed Junior's cable. In every compartment, eyes blinked from behind the storage containers.

"Joshua," Hermes announced. "The keeper is saying something else."

"Pipe it in."

The keeper's words bounced from the asterie to *Raven*, to the antennas and repeaters at the hangar airlock, down the fiber optics cable in the passages to the transmitter that Lucas carried, and into Joshua's space suit earphones.

"Joshua," the keeper said in its always-calm voice. "I request that you not deface the property of Daedalus Genetics, LTD."

"We're not defacing anything," Joshua said.

"There is a person in your party who is defacing the walls."

Joshua looked around. Ann stood by the portal, lipstick dispenser in hand. A red wedge was scrawled on the adjacent wall.

"I got the idea from a movie," Ann said. "You want me to stop?"

Lucas wiggled his tablet. "I'm video-logging our journey. And anyway, all we have to do is follow the cable out."

"Keeper," Joshua said. "The marks will wipe off." To Ann: "Keep doing it. I like having back-up procedures."

They continued down ramps and through passages, tracking Junior's cable. Joshua raised his eyes to the ceiling. In every compartment, he saw the same arrangement of light fixtures, ventilator grids—and little black hemispheres.

Cameras, he thought. *It's watching*.

Lucas viewed his tablet. "This next room is where Junior's cable broke."

Joshua halted at the portal. Unzipping his carrybag, he removed his rifle and slung it over his shoulder. Ann and Lucas imitated. Squeezing the rifle grip, breath heavy and heart pounding, Joshua crept to the frame and peered through.

On the floor, between container pallets and rat eyes, Junior's cable extended to the opposite wall—and terminated.

Lucas examined the cable end. "Look how frayed this is."

"Rat chews?" Ann asked.

"Looks like it was severed by something blunt. And powerful."

Ann did a full turn. "Where does the cable continue?"

A freezer unit occupied the center of the compartment. An electrical cord trailed from the side. Its plug lay on the floor. Joshua looked for an outlet. There wasn't any nearby. He pointed his laser-beam temperature sensor at the freezer unit's door seal.

"This freezer was running until recently," he said. "Then it was unplugged."

"By who?" Lucas asked.

"That is the question. Keeper, are you still on the line?"

"On what line, Joshua?"

"Never mind. Got a question for you. Besides us in this room, are there any other humans aboard this asterie?"

"No, Joshua. They have all been evacuated."

"What about robots?"

"My robots have been evacuated. There is also your robot. There are also five unidentified robots which entered the maze unauthorized thirty-seven days ago."

"Those sound like Hamilton's doing," Joshua said to Lewis and Ann. To the keeper: "The unidentified robots. What is their status?"

"They have not moved in thirty days. Analysis indicates loss of battery power."

"So, Keeper," Lucas said. "Who unplugged this freezer?"

"No further information will be provided," the keeper replied.

"You know, Keeper," Lucas said, "that refrain is starting to annoy."

The keeper remained silent.

"Maybe the rats unplugged the freezer," Ann said. "I realize that sounds like I'm obsessing over them—but they do have the ability."

"I can't see their motive," Joshua replied.

Ann crossed her arms. "Well, do we have a search plan? I mean, this place is creeping me out—the evacuation, the rats, the bullets. I'd like to get done as soon as possible."

"Hermes calculated there's over half a billion cubic meters here," Lucas said. "If we just bumble around, it'll take forever."

Joshua thought for a moment. The direct approach, he decided, was often best.

"Keeper."

"Yes, Joshua."

"You're watching us, aren't you?"

"Yes, Joshua. I have been ordered to monitor intruders. I regret the compromise of your privacy."

"That's all right. So you know where we are. Keeper, I have a request."

"Yes, Joshua."

"Can you guide us to the main lab?"

"No, Joshua. I have been ordered not to direct intruders there."

Lucas smiled. "Guess that was worth a try."

Joshua thought again. People rushing to evacuate, forgetting that computers are often literal-minded when it comes to interpreting commands—

"Keeper. Can you guide us to the room *in front* of the main lab?"

"Yes, Joshua."

"Keeper, guide us to the room in front of the main lab."

"Yes, Joshua. Please go through the door on your right."

Lucas dropped his jaw. "Joshua, next election for captain—you've got my vote!"

Joshua released the rifle grip. Mindful of the overhead camera and the possibility that the telemetry might someday be viewed by a court-of-arbitrage jury, he stuffed his weapon back into his carry-bag.

"Okay. Let's head—"

He saw Lucas frowning at the wall where the cable had broken. Lucas ran his gloves along the surface, and pounded.

"What's up?" Joshua asked.

"According to Junior's telemetry," Lucas said, "there should be a doorway here."

"Portal," Joshua said, reflexively giving the standard space-freighter terminology. "I don't see one."

"Well, I thought I reviewed the video correctly." Lucas shrugged. "Maybe I made a mistake. Been known to happen."

Joshua found he couldn't let it go that easily.

To Joshua, the main lab was merely boxes of lights and switches juxtaposed with liquid-filled tanks and interconnecting tubes. Ann's eyes were aglow.

"I wish we could salvage this just to play with it!" she said. "This is the best gene-editing equipment I've seen in the Belt."

Batting Lucas's hands away from a workstation keyboard, Joshua inspected a wall with shelves of transparent jars like inverted space suit helmets. The bowl interiors seemed coated with sea salt and slime.

"Artificial wombs," Ann said. "A little small for unicorns, though."

"Guys!" Lucas called.

They joined him at the other end of the lab. From a second-story perch, a picture window overlooked a chamber larger than a terrestrial city's sports stadium.

Beneath the light fixtures that dangled scores of meters overhead stretched a vista of hundreds of meters. The chamber contained a forest of gnarled, barren trees, prickling a landscape of hillocks and gullies. Clearings of yellowing grass broke the treelines.

The largest clearing, on the right, had a dried lake bed, orange with rust. The lake bed abutted the only wall visible from the laboratory window. The curvature of the asterie hid the other ends of the forest from their sight.

"An ecosystem module," Ann said. "This must be where they tended the grown specimens."

"It hasn't been watered for a while," Lucas said.

"Gloomy, too," Ann said. "Half the lights are burnt out."

"Let's find the storage unit," Joshua said.

The main room of the lab diverged into short hallways lined with doors. Joshua read the door plaques.

"Fifty-four alpha. This is it."

The door was locked, the first time they'd encountered a locked door since coming aboard. A brief whir of Joshua's drill annihilated the lock mechanism. Joshua entered the storage unit and, cutting the refrigerator padlocks, compared the serial number on Hamilton's purchase order with the labels on the embryo packs. He immediately frowned.

"There are two different serial numbers here," he said.

They withdrew a finger-sized bottle from each pack. Ann inserted the needle of her DNA comparator into both.

"This first one registers as genus *Equus*—which is right for horses," she said. "I wish I could be more specific, but unicorn DNA is proprietary, so it's not in my comparator's genome library."

"How about the other pack?" Joshua asked.

"Definitely not *Equus* . . . wow, whatever it is, it's been heavily modified. But my educated guess would be . . . order *Rodentia*."

"*Rodentia*," Lucas said. "Rodents?"

"Uh-huh. Maybe they were experimenting with pest control. Goodness knows they need it."

"So we take the horsies, leave the mousies?" Lucas asked.

"Not so simple," Joshua said. He stabbed at the hard copy of the purchase order, which he had carried from Scarborough. "The *Equus* number isn't listed. The *Rodentia* number is."

"Their inventory data base is probably confused," Lucas said. "If you'll let me hack their system—"

"No. The easiest solution is to take both. We'll return parcel-post whichever Hamilton doesn't want."

They wrapped the embryo packs in insulation and stuffed their carrybags to overflowing.

"Lot of baby unicorns here," Lucas said. "Is our friendly and trustworthy client planning to raise a cavalry regiment?"

"All Belters are crazy," Ann said. "Look at us."

Joshua frowned at the serial numbers on the packs, then slung his carrybag's strap over his shoulder, staggered to the door, and motioned outward.

"We've got what we came for. Let's go see stars again."

"About time," Ann said. "All this talk about mazes has me scared we'll run into a minotaur."

"That could happen in a genetic engineering facility," Lucas said.

"Lucas, honey—please shut up!"

Joshua crowded out fears of minotaurs with a daydream of their traditional post-mission espressos-and-cookies in the coziness of *Raven's* control room. He was halfway to the lab exit when Ann cried out. She was staring through the window toward the clearing.

Not more than a few meters distant inside the ecosystem module, a snow-white horse munched on the sparse grass.

The horse had a mane tangled with elflocks. Its eyes were wide and liquid. Upon its head projected a golden-hued horn like a jousting lance in quarter-scale.

It happened too fast for Joshua to stop her.

Shedding her carrybag, Ann descended the stairwell, flung open the door, and entered the ecosystem module. With more caution, the men followed.

The unicorn perked, neighed, and trotted to the clearing edge, as far as it could go without entering the woods. It surveyed the three of them, swishing its tail and grunting. Its head bobbed and the horn flicked like a swordsman's parry.

"She's so pretty!" Ann said, after briefly stooping to determine sex.

"A little on the thin side," Lucas said. "Little ragged, too."

"Dehydration." Ann sighed. "This whole place is run down. There's hardly any grazing. Poor thing!"

"Ann," Joshua said. "It's an untamed creature, we have no ability to capture it. Didn't you say you wanted to leave?"

The unicorn made a noise like, "*Ruhubhbhh!*"

Ann grabbed Lucas's carrybag. She extracted a fistful of red-and-white wrappers.

"Hey!" Lucas cried. "My stash!"

Peeling off a wrapper, Ann held out a chocolate bar and approached the unicorn, step and halt, step and halt. The creature grunted and stamped, like a bull preparing to charge. Watching the horn tip's circles, Joshua slowly reached into his carrybag.

"Don't you dare, Joshua!" Ann said. "My suit will protect me from the horn."

Joshua curled his finger around the trigger just the same.

Midway across the clearing, Ann stopped. The unicorn examined the candy with both eyes and flaring nostrils. It trotted forward and its teeth pried the bar from Ann's fingers. With a gulp, the bar vanished. Ann unwrapped a second bar.

As the unicorn munched, Ann delicately slipped alongside, whispering gently. The creature grunted and bobbed its head, as if in comprehension. The horn stayed pointed away from Ann.

"'Constance,'" Ann said lightly. "My daughter Reena has a stuffed unicorn named Constance. That's a good name for you." She stroked the mane. "Your hair is so soft, Constance! And you're so well-behaved!"

"She's a moocher, that's what she is," Lucas said, as Constance the unicorn nibbled on the chunks of a third bar. Lucas turned to Joshua. "Perhaps we should discuss who'll clean up after this charming beast, assuming we take her aboard *Raven*."

"I'll do it," Ann said. "Horse lovers run in my family. Besides, handling a horse will be no trouble after cleaning up after you two!"

Lucas placed his hands on his hips. "Ann, you are being unfair. Accurate, irrefutable—but also unfair."

Suddenly, the unicorn's ears twitched. Her eyes widened still more. She bolted into the woods, a streak of white swallowed into the gloom.

"Something spooked her," Lucas said. "But I don't see or hear any—"

Ann stared at the swaying branches—then plunged after.

"Ann!" Lucas shouted.

Joshua raced after Lucas, who chased after Ann. Overhead, the branches blocked the faltering illumination. Around Joshua, shadows merged into thickets of black. Animated stickers whipped his space suit and snapped at his helmet.

In the murk of the forest he thought he glimpsed a spider web large as a man, a spider big as a bowling ball. He saw the bones of a half-eaten pterodactyl carcass. He saw hulking silhouettes that *had* to be his imagination.

He came to a fork in the trail. On the left, a branch swayed. He went left. Then he broke into a clearing. Ann and Lucas were frozen, gaping at the gully below. Since it took him a moment to accept what he was seeing, he froze too.

Row upon row of huts ran parallel to the dried stream bed at the bottom. The huts had walls of sticks and stones, roofs of straw, and bare apertures for windows and doors.

The tallest roof towered no higher than Joshua's knee cap.

"Does this mean what I think it does?" Lucas asked.

"Back to the lab," Joshua said. "*Now.*"

Through the windows, furry heads peeped beady eyes.

Joshua swung open the lab door and ushered the others in. He sprang after them and slammed the door. Breathless, he clambered up the steps.

Beyond the window, on the far side of the clearing, the tall grass shook. Joshua expected a wave of brown fur to wash out. Instead, he saw a flood of leaves.

The rats wore caps of leaves, and around their waists, cinched by strands of grass, were jackets of leaves. Their mock uniforms blended with the dead leaves matting the ground.

Maneuvering into the clearing, the rats formed into squares of hundreds. At the forefront of each square pranced a larger-than-average rat attempting to lumber upright while waving a sharp stick. Joshua saw petals of marigold gracing the shoulders of the uniforms of the leader rats. Next to each leader, a pair of smaller rats held ceilingward a long branch with three leaves skewered. Joshua thought of epaulettes and regimental colors.

"It's like a miniature army," Lucas said. "How do they know to do that?"

"It's taken decades to program their instincts into imitating human military tactics," Ann said. "But that's all it is. Instinct and imitation."

"Like bees and their hive behavior coupled with monkey-see-monkey-do?"

"Yes. Instinct and imitation. That's all it is. Despite the name, *intellirats* are more clever than intelligent."

"You can only genetically engineer so much strategy into brains the size of walnuts," Joshua said. He wondered how much military strategy that was. Likely, he thought, he had only a peanut's worth himself.

The squealing rattled the lab window. The multitude of cries were regular and synchronized, chants led by the officer rats and directed toward the humans.

"Why are they so furious?" Lucas asked.

"We violated their territory," Ann said.

"Let's stay out of sight," Joshua said. He headed for the exit. "We have what we need, let's—"

Ann stood by the window, glaring. "We're abandoning Constance? In there, with them?"

"We—we can't—we have to—" Joshua couldn't form a complete sentence under her scrutiny. Then he noticed Lucas.

Lucas stared at the flashing screen of his computer tablet, clutched in both hands with far more of a grip than required in a point five geefield.

"Something wrong, Lucas?" Joshua asked.

"Radiation detector," Lucas said. "A significant increase in iodine-131."

Joshua and Ann traded glances.

"How much is the gamma?" Ann asked.

"Point three millirem per hour. Is that harmful?"

"Not if we're leaving right away."

"It shouldn't be anything at all," Joshua said.

He examined the history graphs for counter-and-average-MeV.

After a period of time, Ann said: "The reactor is running high, isn't it?"

"At fever—since about forty-five minutes ago," Joshua said. "Maybe Hermes can tell us what's happening." Hefting the fiber optics cable spool, Joshua flipped the transmitter switch. "Hermes, you there?"

Hermes wasn't. After a few calls of wasted breath, Joshua glanced at the ceiling grids.

"Keeper," he shouted through his helmet glass. "Can you hear me?"

"Yes, Joshua," said the voice from a circular grid.

Joshua adjusted his helmet external-microphone volume.

"What's the status of your reactor plant?"

"I have placed my primary reactor at maximum power and am disengaging all safety features," the keeper said, in a voice whose dispassion matched that of a human describing how to bleach stains from laundry. "I am preparing to pump ice-cold water into the core. This will result in a rapid and extreme temperature transient that will stimulate a high flux of thermal neutrons, leading to explosive meltdown. The meltdown event will fulfill my directive to self-destruct upon intruder penetration of the main laboratory."

There was a long silence.

"It's the intellirats, isn't it?" Ann said. "We found out about the intellirats."

"Yeah, Daedalus Genetics has to destroy the evidence now." Lucas shook his head. "If there's anything that'll summon the navies of a dozen asterie alliances to your doorstep, it's breeding intellirats."

"Keeper!" Joshua shouted. "Return your reactor to normal operation!"

"I am sorry, Joshua," the keeper replied. "You do not have countermand authorization."

Joshua opened his mouth to shout again, but Lucas interrupted: "Keeper, when will meltdown occur?"

"There is a point nine nine confidence interval between seventy-five and eighty-one minutes," the keeper replied. "I regret that unknown reactor tolerances prevent a more specific answer."

Joshua adjusted his watch. "Lucas, does that give us enough time to leave?"

Lucas skimmed the video log of their inward journey. "If we don't delay." He looked at Ann.

Ann turned from the woods. Her face had no tears, just a hollow glaze.

"Let's go," she snapped.

Exiting the lab, they followed the cable through portals, past pallets. Joshua's legs increased speed unconsciously. And so, head bowed, he almost slammed into a wall.

He picked up the frayed cable end. "Blunt cut. Like the other one!"

Lucas compared his computer tablet screen to the wall. "According to the video, there should be a door—a portal—here!"

They slapped the bare surface. It didn't make a portal appear, not even a crack.

With his boot, Lucas nudged another disconnected electrical plug. "Who's doing this? An energy-conscious minotaur?"

"The keeper may have lied about not having robots," Joshua said.

"Joshua, I told you, the keeper can't lie!"

"Lucas, there's the cable and there's the wall. Either we walked through the wall or this cable has been rerouted."

"Well, is the keeper editing my video log, too?"

"It's got to be the right place, Joshua," Ann said. She pointed to the lipstick mark on the portal frame.

Joshua sighed. "We don't have time for this." Conscious of his flushed cheeks, he tucked his irritation away. He keyed in his laser gyro, determining the direction of the hangar. "We need to go through this wall."

Lucas blinked. "You mean, *blast* through it?"

"I, for one, am not worried about lawsuits anymore," Ann said.

Lucas taped the explosive charge in place. They hid in the adjoining room. Lucas tapped his computer tablet screen. The portal flashed and the boom shook the walls. Debris flew past. They poured back into the other room. A hole smoldered in the center of the wall.

Joshua strode toward it, but not fast enough.

The wall moved back. The ceiling parted. Down came a new wall, joining with the floor and adjacent walls. The ceiling closed up.

They faced a bare, smooth wall. If they had delayed reentry into the room, it would have seemed as if the detonation had been without effect.

Gingerly approaching, Lucas examined the new wall, rapping his knuckles on the edges and corners.

"Electromagnetic induction coils," he murmured. "That's how it moves so fast."

"But *why*?" Ann demanded. "I mean,

why would an asterie have walls that *move?*"

Being mesmerized, Joshua took a moment before he could speak.

"Ann, you agreed Daedalus was like a flying warehouse, drifting from one customer- and supplier-asterie to another as it orbits through the Belt. Well, to maximize storage efficiency, it has to reconfigure itself to cargo allocation requirements, which are constantly changing."

Lucas nodded. "You're saying the keeper automatically remodels its interior to adapt to its cargo?"

Ann sighed heavily. "Only in the Belt!"

"Not just here," Joshua said. "I've heard about this on Earth, too. Commercial airlines have been doing it for over a century. In the daytime, a jet will fly with passenger seats. At night, the seats are removed and pallet tracks are installed, to haul freight. It's so routine, they don't even use robots anymore. The jet reconfigures itself."

"A *dynamic* maze!" Lucas said, his eyes lighting. "That must be the key, how the keeper rationalizes its actions! It always provides a way of escape, so it can justify to itself that it's not actually trapping us. But the escape route constantly shifts in response to our movements, so that—"

"So that we're always going the wrong way." Joshua raised his eyes to the ceiling bubble. "Keeper! Can you take us to the room that is next to the hangar?"

The keeper's voice was prompt and smooth: "I'm sorry, Joshua. That would facilitate your escape."

"It's learned that trick," Lucas said.

"Keeper," Joshua said. "Do you realize that the meltdown will kill us if we cannot escape in time?"

"In regard to the meltdown event," the keeper replied, "while normally my ethical parameters would require me to release you in the face of imminent danger, my self-destruct directives are an exception and must exclude any consideration on my part with regard to your personal safety."

"Keeper, that's not logical!"

"I believe you are incorrect, Joshua. My programming instructions are explicit. Human Life Protection overrides all priorities except Self-Destruct. Self-Destruct is independent of Human Life Protection."

Joshua felt his face grow red, his stomach churn. He also felt a need to punch something.

"*Keeper—*"

"Joshua," Lucas said quietly. "Don't argue with the computer."

Joshua unballed his fists and slowed his breathing. "All right. Lucas, can we blast our way back to the hangar?"

"Not if the keeper throws a hundred walls in our way. Even just ten. I only have nine more charges."

For an instant, it got to be too much. Swirling into a maelstrom of worries, Joshua bowed his head and closed his eyes.

"I'm sorry," he said, covering his temples with his hand. "I worked on freighters, I should have thought of reconfigurable compartmenting before this."

Feeling a palm on each shoulder, he opened his eyes. Lucas and Ann smiled at him. Small smiles . . . but enough.

And by then, he remembered . . . the rust.

"Let's go back to the ecosystem module," he said.

"The rat's nest?" Lucas asked.

"I hope you can think of a better idea on the way. Mine isn't that good."

Inside the lab, Joshua pointed through the window at the orange bottom of the dried lake bed near the right-side wall, about a hundred and fifty meters distant. There were no rats in the foreground, no unicorn anywhere.

"Because of the heaviness of its biomass," Joshua said, "the ecosystem module is built right on top of the inner surface of the asterie's outer shell, with no levels underneath. Right?"

"Gotcha," Lucas said. "You want to blast a hole through the shell."

"The lake bed's rust must be from the steel shell. That's where we'll do it."

"Then we jump through the hole?" Ann said. "That's your plan?"

"The rim rotation is fifty meters per second," Joshua said. "That'll throw us clear of the meltdown. Hermes will have the skiff pick us up."

"Joshua," Lucas said. "I once saw this documentary on World War II battleships. Their plating was two feet thick. The average asterie's shell is three times that."

"I'm not optimistic, either."

Joshua descended the steps and opened the door. His earphones filled with the shush of a breeze from distant, hidden ventilator fans. With suit external microphones at maximum sensitivity, he listened toward the woods. He heard something like the caw of a crow on steroids. There were no squeaks or squeals.

They gripped their rifles and flicked the safeties. Joshua crossed the clearing. Lucas and Ann tagged closely.

From ground level, Joshua could not see the lake, but above the trees he could see the wall that he knew was adjacent to the lake. He entered the woods and at the fork took the trail on the right this time, heading toward that wall.

A herd of scarab beetles with luminescent racing stripes scattered from the path. Stickers blocked, waving like octopus tentacles. Joshua thrashed with his rifle barrel. The stickers fought back. He slashed with his knife. Hissing, the stickers parted, revealing the lakeside clearing.

Bounding with half-gee leaps, Joshua reached the dry lake's shore.

Pack by pack, Lucas tossed a pile of explosive charges onto the corroded bottom. Then he backed from the shoreline and crouched. Joshua and Ann got behind him.

The lake bed boomed and a pillar of orange dust billowed roofward. Joshua ran to the edge. The cloud cleared, revealing . . . a shallow crater.

"It hardly made a dent!" Ann cried.

"Joshua, that was it," Lucas said. "I have one charge left."

"Maybe," Joshua thought aloud, "the charge will have more effect if we cover it with rocks and—"

"One charge won't punch through two meters of steel!"

"Joshua," Ann said.

The tall grass by the woods was shivering. Out marched a carpet of leaves, marigold-epaulettes dancing and banner-sticks waving. Chanted squeals echoed against the module wall.

From Joshua's right to his left, the rats advanced in a semicircle that constricted around the humans standing at the centerpoint of its radius.

Joshua raised his rifle, took aim, and fired. A rat leaped into the air and flopped. The humans spread rifle fire in a trisected pattern. Stampeding over the bloodied corpses of their stricken comrades, the rats retreated to the tall grass. But the grass continued to shiver.

"They're not going away," Joshua said.

"I told you, they're territorial!" Ann said.

"I think they've got us surrounded," Lucas said.

Suddenly the grass stilled. Then Joshua heard a loud squeal, followed by simultaneous clicks from everywhere in the grass before them.

Black rain-in-reverse erupted from the grass.

The dark speckles arched skyward and careened toward the humans. Joshua shielded with the carrybag and cringed. A hail of pebbles rapped against his helmet and arms and stung the ground.

"Catapults!" Lucas cried. "*How can they have catapults?*"

In a fleeting instant, Joshua pictured miniature medieval-style catapults mounted on tiny wheeled carts with windlasses no larger than sewing-machine spools, ropes as thin as thread. Rationality told him the "ratapults" could be no more than flexible sticks gouged into the ground and bent under the weight of a gangpile of rats. But all he saw, in a one-eighty panorama with his back to the lake bed and module wall, was furiously agitating tall grass.

He heard a rat shriek. The grass clicked. Another storm of projectiles streaked toward the humans. Rocks and beetles and clumps of muck pelted their suits. Under cover of catapult fire, the rats charged. The humans retreated into the lake bed.

They crowded side-to-side, scanning the lake's perimeter, which was then above eye level, and they waited for the rats to rush the edge. Conducting a mental inventory of their remaining ammo, Joshua wished he could trade his rifle for a chain saw.

"More clever than intelligent!" Lucas mumbled. "So they can't compose a symphony at us!"

Abruptly, a riot of squeals came from above.

Joshua heard whinnying, then hoofbeats. A rat carcass tumbled onto the lake bed, flinging droplets of blood from its wounds. The humans climbed to the shoreline.

The unicorn galloped across the clearing, stamping the tall grass, dipping its head and swinging its horn like a metronome set to allegro. Skewered rats flew outward in waves as the rest scrambled.

In seconds, the rats vanished. Their squeals faded into the woods. The unicorn made prancing circles and snorted. Joshua and Ann helped Lucas onto the grass.

Ann ran to Constance. "You saved us, sweetie! You're wonderful, you are!"

Its neck enveloped in Ann's embrace, the creature grunted and bobbed its head, seemingly in agreement, giving Joshua the impression that modesty was a quality yet to be engineered into the Plantagenet Line. But there was no question, he admitted as he surveyed the piles of impaled and blood-soaked carcasses littering the field, that the battle had been well-fought.

Lucas peeled a wrapper and held out a bar. "Babe, you deserve a hundred more for that!"

While the unicorn nibbled, Joshua gently brushed his fingertips against its hide. It was trembling, and beneath the hairs he traced tiny scars.

"She's fought quite a few battles," he said.

"We can't leave her here," Ann said.

"I know."

Joshua gazed at the shallow crater in the lakebed. Lucas and Ann turned their attention from Constance and gave him what-do-we-do-now-captain looks.

"Well," he said. "We have to figure another way out."

"Will the reactor melt a hole in the shell?" Lucas asked. "We could jump through that."

"The heat and radiation would fry us before then. This whole asterie will be super-heated into vapor."

Lucas scowled. "Didn't our client tell you this place was harmless?"

"Toothless. Lucas, you want to try hacking into the system and overriding the self-destruct?"

"Even if I had all my gear—well, I'll try."

They started toward the lab. Ann's hand suddenly clutched Joshua's arm. She pointed to the trees. The bare branches drooped with squirming rats.

The humans froze and watched.

"Can they unlatch our helmets?" Lucas asked.

Ann's reply was barely a whisper. "Wouldn't put it past them."

Joshua heard a crack from the trees. Another crack, and dirt exploded by his boots. Something metallic and rodlike glinted in the branches. An end of the rod sparked, and something whizzed by his helmet—far faster than a catapulted pebble.

"Get down!" he shouted.

They dropped to the grass as gunfire

erupted from several trees at once. Bullets whizzed overhead and ricocheted against the module wall. Hugging the ground, the humans crawled to the shoreline and rolled onto the lake bed, into concealment from the arboreal snipers.

Ann whistled. "C'mon, Constance!"

With a leaping glide, the unicorn landed onto the rusted bottom. A rain of pebbles clattered after. Red streaks on Constance's haunches revealed where the missiles had grazed. Ann stopped hyperventilating only after she assured herself there were no bullet wounds.

"They must have broken into the armory," Joshua said, catching his breath. "Now we know what caused the evacuation."

"How can they know how to shoot?" Lucas asked.

"They must have seen humans doing it," Ann said. "They're very imit—"

Another volley of bullets ricocheted against the module wall. Joshua examined the wall, surveying its entire length. It was a sheer plane of metal.

"I don't see any exits," he said.

"The module walls have to be sealed for waterproofing," Ann said. "They're different from the cargo walls."

Lucas hefted his last charge. "You mean, they don't move around?"

Lucas climbed to the wall with a haste that belied his body-to-fat ratio. He set the charge, retreated to the basin, blasted a hole. It remained unplugged. Through the jagged gap, they slipped out of the ecosystem module, into a cargo compartment. With some coaxing, Ann got the unicorn to follow.

Joshua looked back. The clearing showed a carpet of leaves rolling toward the hole, guns and rifles riding atop the swellings.

He checked his gyro compass and pointed right. "The hangar's this way."

Ann petted and prodded the unicorn after them into the next room. Lucas ran to the next portal and yanked the handle. It refused to budge. He bored the lock mechanism with a number-three bit. He flung back the door and motioned.

Joshua looked at his suit clock. They had nearly an hour left, but what of it? They would be chased by rats through the maze, never coming even close to the exit, even if the keeper were to leave all the portals unlocked. For it would rearrange the walls, and escape would always be impossible.

If only, Joshua thought, he could make the keeper realize their lives were in imminent danger from—

Joshua halted.

Another idea had come. He didn't think it was a good idea. The risk, for one thing, was far worse than blasting through the lake bed. If he was wrong, the rats would not forgive . . . .

"Joshua—let's move!" Lucas shouted, waving toward the next portal. "Come on!"

"No," Joshua said. "Not that way." He referenced the compass arrow and nodded toward the hangar. "This way."

"We can't go that way!" Lucas shouted. "There's no portal! Now come on—they're right behind us!"

"Exactly," Joshua said. He drew himself up. "And we need to get them around us, also."

Lucas's mouth went slack. "Are you crazy?"

I wonder too, Joshua thought. "Lucas, we have to force the keeper to choose!"

Pouring through the hole blasted from the module, the rats overflowed the previous room, abandoning their leaves as the camouflage was no longer of use. The humans took cover behind palleted cargo. The unicorn trembled and bucked, making threatening circles with her horn tip. Ann took a syringe from her med pack and jabbed the creature's flank. Constance calmed.

The rats charged. Joshua squeezed his trigger. They returned fire.

From overhead came skittering noises. A ceiling grid popped open, a rat head poked out. Joshua blasted it off its shoulders.

"The ventilator shafts!" Lucas cried. "They can go anywhere in the maze!"

"That's good," Joshua said. But he had his doubts. If the keeper didn't split the fine hairs of philosophical reasoning the same way that he did—

"*Joshua*," the keeper's voice boomed from the ceiling grid. "You are being surrounded by creatures which I have determined are hostile to human life. You must move away. Please go through the portal on your right."

"No, Keeper," Joshua said.

"Joshua, this is a matter of your personal safety. Please go through the portal on your right."

Lucas stepped toward the portal. Joshua grabbed him.

"No. Wait!"

Through the portal on his right, he watched the floor vanish beneath the mass of rats dropping from the ventilator shaft. Ann raised her rifle barrel. Joshua pulled it down.

"Let them come," he said. "Please trust me on this!"

Anxiety kept him from articulating, but in his mind, he visualized the situation. He thought of the hangar as being at the asterie's North Pole. To reach the hangar and safety, they needed to go north.

Rats were coming from the portal in the south. Through ventilator shafts, the rats had filled the rooms above and west. East was the module. Below was two meters of steel.

That left the humans only one way of escape from the rats. To the north—to the hangar.

"Keeper," Joshua said. "We're surrounded now, except for one room. You must open the wall to that room, or we will die. And you are responsible."

"No, Joshua. You are responsible for placing yourself in jeopardy."

"That *was* true, Keeper. However, now the situation is out of my control. Now *you* are responsible for whether we live or die."

The keeper was silent. The machine that could perform complex arithmetic calculations in picoseconds took humanly measurable time to contemplate ethical equations.

"Keeper," Joshua said, above the rising clamor of the rats. "This has nothing to do with your self-destruct sequence. You cannot claim an exception to your ethical programming. Open the wall, or the rats will kill us—and *you are responsible*!"

The keeper's programming instructed it to insert emotional intensity into its voice: "*You must move, Joshua! You must move to another room*!"

The rooms on the other sides of the portals seethed shin-deep in rats. Surely the keeper saw! Joshua feared: could a machine experience denial?

"It's too late for us to move anywhere without your help," Joshua said. Then, for the sake of his listeners—including himself—he forced his voice calm: "You must help us, Keeper . . . or cause us to die by your inaction."

They waited. The rats howled. The room shook with the thrashing of the horde.

Joshua heard a hum behind his back.

The wall to asterie-north rose into the ceiling, revealing the one still-ratless adjoining room.

"Joshua," the keeper said. "Move into the room I have opened—now!"

The humans backstepped northward. The rats surged after. Lucas raced for the next portal. But it faced westward and he caught himself and nodded at Joshua. They waited for the rats to catch up.

"We have to do this one room at a time?" Ann asked. "All the way out?"

The next northward wall opened. The humans stepped through.

The rats quickened the pace, emboldened by each retreat and enraged by each wall-raising escape. The keeper waited too long, sometimes. Joshua poured his bullet clip into the horde, attempting to keep the fangs beyond glove-nipping distance.

With somersaults and hops, the rats proved as adept as cinematic ninjas at evading Joshua's aim. They dodged the rifle snout and leaped onto his body. Their paws sought his external suit controls. They shut down his airflow fans. They ran his heater coils at full blast. They popped his ears with pressure charges. Worst of all, they scratched at the helmet locks.

His ammunition clip emptied. Lucas's gun clicked. Then Ann's. Then the humans used their firearms as clubs.

The keeper, finally recognizing their predicament, opened the remaining walls.

With half an hour remaining until the point nine nine interval, they reached the end of the cargo spaces and entered the permanent decks of personnel quarters, and in the straight passages they shook the rats off their suits and outran the tiny legs of their pursuers. At last they reached the hangar.

Joshua and Lucas cycled through the personnel airlock, unrolled and inflated the skiff's transport bubble. They pressed the seal against the transport docking mechanism. Ann swathed the horn tip inside bandages. With urging and shoving, a double-dosed Constance bemusedly trotted into the bubble.

Then Ann stared toward the mouth of the hanger.

"Joshua, why are there *two* skiffs?"

When Joshua turned, there were not only two skiffs, but five men emerging from behind a fuel tank. One of the space suits was jet black with gold trim. Smiling through the face plate was the Lord of Scarborough.

"Greetings, Captain Wang," Emil Hamilton said. "All of you, drop your weapons. Bags too, please. Or would you rather we blow off your legs?"

Under the aim of five automatic rifles, Joshua, Lucas, and Ann released their bags and empty weapons.

"Prior to engaging your services," Hamilton said, "I contracted a team of Nemesis Commando Robots. Top-of-the-line strategic-reasoning AIs—augmented with state-of-the-art armor and weaponry. They entered that airlock behind you weeks ago, and have failed to return or signal. Their loss cost me far more than thirty thousand credits. So, Captain, I'm interested in learning how *you* solved the keeper's maze."

Joshua kept his eyes still, but took in the situation. In front of him, armed men blocked escape to *Raven*'s skiff. Behind him, on the other side of the airlock . . . *yes*. But he had to play for time . . . to let one threat catch up to another.

"Before I tell you anything," Joshua said, "I'd like to know about *your* plans."

Hamilton laughed. "I suppose I won't mind boasting."

"The unicorn was just a cover to do business with Daedalus Genetics, right? You really wanted intellirats."

"Very good."

"But what do you want intellirats for?"

"Surely that's obvious. I want them for what everyone else wants them for. As a weapon, to infest other people's asteries."

"But why would an asterie developer want to damage asteries?"

"Let me explain the process. It all has to do with Scarborough. Scarborough is a tourist attraction. When the tourists go home, they take the rats with them aboard their return shuttles. Unknowingly, of course. Then the rats infest the tourists' home asteries. My consortium buys the infested asteries at depressed prices. Then we exterminate the rats, and sell the rat-free asteries at market prices. We make a considerable profit, and will be regarded as saviors of otherwise uninhabitable asteries."

"So long as no one tells the secret."

Hamilton smiled thinly.

Joshua glanced at his crew. Their eyes were wide, fixated on the gun barrels aimed at their chests.

Joshua continued: "I don't see how

you expect to get rid of the intellirats, when even Daedalus Genetics couldn't."

"This asterie was overrun by an earlier, less controllable version of intellirats," Hamilton replied. He gestured toward their carrybags. "Those particular embryos have been engineered to grow an organic antenna inside the skulls. The proper coded radio signal, at the correct frequency, and the rats die instantly, en masse."

"But isn't there a problem getting them into other people's asteries in the first place? All the inspections, the detectors, the scanners—"

"The rats are designed to survive briefly in vacuum—expanded lung capacity, pressure-barrier skin layers, even hibernation ability. Thus, they can ride on the outside of shuttles, and hop into asterie hangars after docking. And they can operate airlocks."

"I'm sure. But then—"

"Excuse me, Captain. You're not thinking of prolonging this until the reactor melts, are you?" A smirk blossomed on Hamilton's face. "And yes, the keeper was thoughtful enough to warn us about that."

Joshua said nothing. Lucas growled at the ceiling camera: "Traitor!"

Hamilton checked his watch. "We'll need to leave soon. So are you going to explain how you escaped the maze?"

"Certainly," Joshua said. "It was very simple. The crew helped us."

Hamilton's smirk faded.

"The—personnel? They've evacuated!"

"Not all." Joshua tilted his head toward the hangar ceiling camera, as if acknowledging an audience.

As his men shifted footings, Hamilton glared at Joshua. "You're lying."

"Look at the three of us. Not exactly paramilitary material, wouldn't you say? But your commando robots never came out, and we did. It's because we had help."

Hamilton shouted at the camera: "My yacht has missiles! I'm warning you!"

"You're not really sure this place is toothless, are you?" Joshua asked. "And your relationship with Daedalus Genetics hasn't been friendly, either. Not lately. Not since you've been boarding without permission."

Hamilton locked his eyes on Joshua. "You're lying! *There's no one here*!"

"See for yourself."

"You!" Hamilton pointed to one of his men, then at the airlock. "Go inside, check! No more than one minute, then come out!"

With a nervous glance at his companions, the man approached the airlock.

He pressed the button. The door slid open. He stepped inside. The door slid closed.

Hustling Joshua and Lucas to one side, Hamilton motioned his other men into firing positions directly in front of the airlock.

Joshua waited, tensing his muscles. Lucas studied the bare deck. Ann gazed blankly and stroked Constance's mane. The airlock door slid open.

Out lunged a screaming man—and a thousand angry rats.

Whirling and staggering, Hamilton and his henchmen frantically grabbed and flung furry bodies from their space suit controls. During the wild dance, one man's rifle fell to the deck.

Mindful of the clinging vermin, Joshua slowly edged toward the abandoned weapon.

Approximately half an hour later, having doffed his space suit, Joshua sat in the control room of *Raven* and watched the pilot's main screen as the skiff bearing Hamilton's henchmen returned to its yacht.

Then Daedalus spewed incandescent and radioactive vapor into surrounding space. The gasses first emanated from the hangar, then from the vents, and then from holes melted along the rim as chunks of the reactor fell through. Finally, the microworld vanished within clouds of superheated mist.

"All the stuff we could have salvaged," Lucas said. "It's not doing anyone any good now."

"Be thankful we got out alive," Ann said.

"Maybe we can get a reward, too," Joshua said. "It depends whether our guest has a price on his head."

He turned to their prisoner. Hamilton struggled with his bonds, but Ann had secured the knots. While continuing to watch the screen, Lucas casually kept a pistol aimed at the small of Hamilton's back.

Hamilton formed his face into a snarl. "Wang, listen! My ship has you outgunned. They're under orders not to accept hostage threats. You may as well surrender right now, because you're not going anywhere!"

"Let me show you why we are," Joshua said.

Joshua clicked screen icons, opening an application window that displayed a graphic of the ships and asterie. Daedalus was interposed between the salvage ship and the space yacht. From the holes in its equator, the spinning worldlet gushed expanding spirals of vapor.

"See this disk-shaped cloud?" Joshua asked. "It's what remains of the interior of Daedalus. Hundreds of thousands of tons of material, converted to plasma-hot gasses. And I've maneuvered so that the disk serves as an impenetrable barrier between our ships. By the time it disperses, we'll be long gone."

Hamilton glared at the screen, then at Joshua. "You won't get far! My ship is faster than yours!"

"You've never navigated through the Asteroid Belt, have you?"

"What's that supposed to mean?"

"Speed isn't everything. Besides, *Raven* is faster than you think." Joshua smiled at Ann. "You have a place to put him?"

"In the main hold with Constance," Ann replied. "If she can take the smell."

Lucas helped Ann escort Hamilton away. Joshua returned his eyes to his console and tapped keys.

The screen displayed a real-time map of the Asteroid Belt, with their current position superimposed upon a shifting field of asteroids, asteries, and spaceships. Sipping his espresso, Joshua touched the stylus to the screen—marking possible courses, identifying potential intercepts.

He was still working when Lucas returned.

"So who gets him?" Lucas asked.

Joshua sighed, resting a hand on the screen. "I'm still analyzing and tagging the scanner contacts—friends, foes, neutrals, pirates, and sovereignties that might take him. Then I have to figure how to weave around intercept ranges and spheres of influence."

Lucas twitched a smile. "Looks like a dynamic maze."

"It's a mess. Everything in different orbits, changing vectors on whim. Long-range transits in the Belt are always miserable for navigators, thanks to the political chaos."

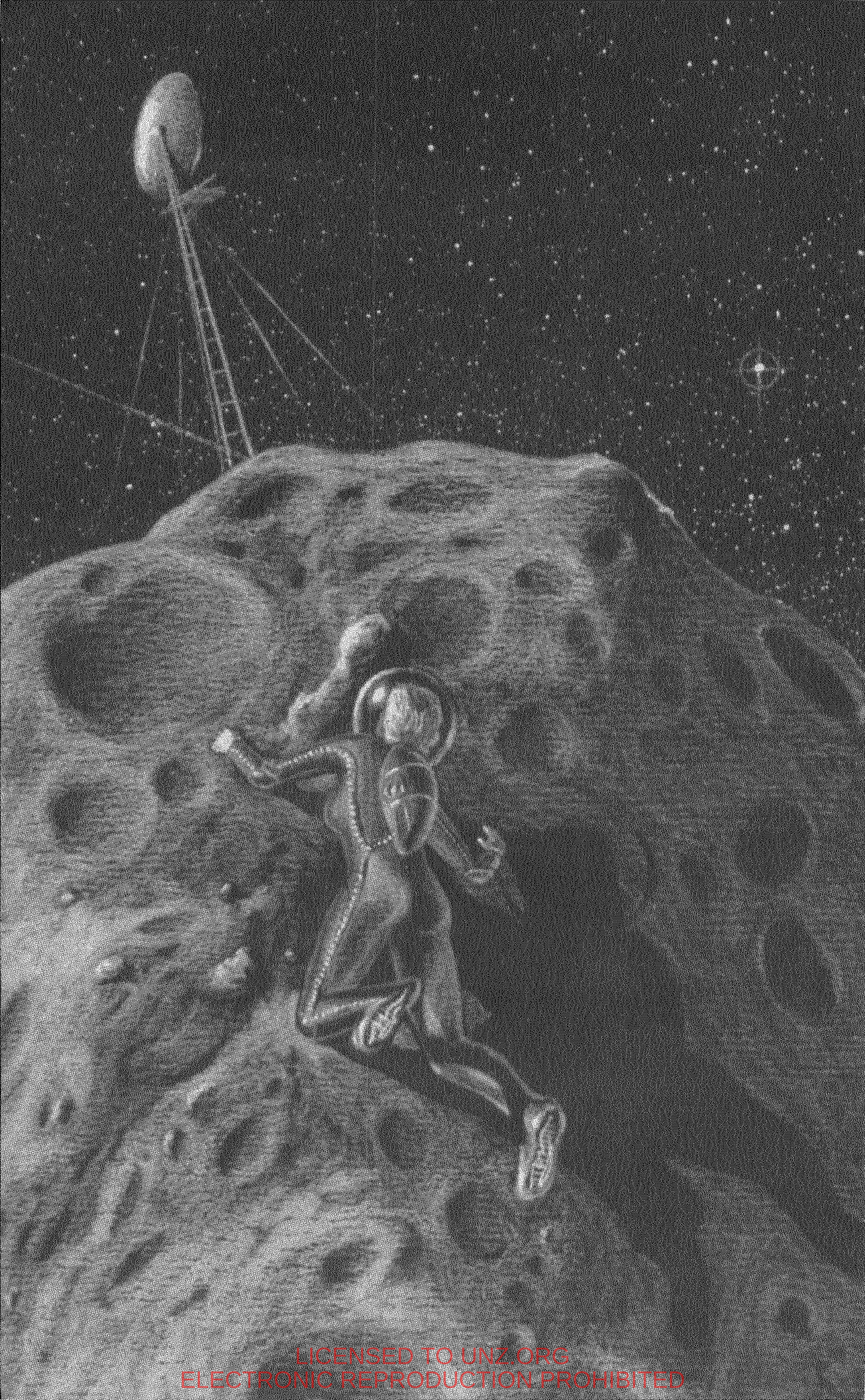
"You'd like the Belt united under one government."

Joshua shook his head.

"That would be like having a keeper run everything. And there'd be no escape."

He set a course. The ship got under way, and they entered the maze. ■

> The greatest dangers to liberty lurk in insidious encroachment by men of zeal, well-meaning but without understanding.
>
> —Louis D. Brandeis



KREMER'S LIMIT

C. Sanford Lowe &
G. David Nordley

When a project is bigger than any ever undertaken...even the first step isn't easy.

Chapter 1

Black Hole Project Headquarters,
Santa Cruz Mountains, 10 April 2257

"But what if you're wrong?" the reporter asked.

Hilda Kremer tried to compose herself. The Black Hole Project auditorium became so silent that the gentle whoosh of maglev traffic on the grassway down the hill could be heard. Even the small gaggle of protesters outside the auditorium were quiet, leaving the air to the calls of birds about their business in the two-century-old redwoods that had grown up around the mountainside building. The four story Mediterranean style mansion had once served as a satellite campus for the University of California at Santa Cruz and before that, a Buddhist retreat. The speaker's platform faced the rose window that once stood over the Buddhist altar, and Hilda often drew a sense of inner peace looking in that direction.

She needed it. They had spent twenty minutes explaining why trying to make a black hole would not destroy the known universe, and here was yet another hostile question.

Project director Dr. Zhau Tse Wen, who had the floor, turned to her. Did he want her to reply to the question? On one hand, his turning to her was a form of recognition; on the other, she didn't want to venture into the minefield of loaded questions. She shook her head. She created intricate, massive computer simulations of subnuclear processes; others strove to make them happen. Desire to make things happen was the enemy of equanimity and clear-headedness.

Tse Wen's mouth turned up just slightly at the corners and he winked. When Tse Wen smiled he reminded her of a contented, if undernourished, Buddhist monk He'd lost his hair before taking his initial telomerase treatments and preferred that look, as it simplified his life. His thinness was not from any asceticism; he simply forgot to eat for days on end. Not infrequently, Hilda and Sarah Levine kidnapped him from his office and drag him over to Sarah's room for a feast of chicken soup and bagel sandwiches filled with kosher sausage slices.

He turned back to the reporter who'd asked the question. "Theory tells us the forces between the electron shells of atoms keep us from collapsing into a tiny ball of neutronium in the center of the Earth. What if we were wrong about that?"

"We don't collapse . . ." the reporter said.

Tse Wen smiled and bowed slightly. "And neither has any naturally formed black hole ever created a new universe on top of us. Please remember, we live here, too."

A titter ran through the room. Hilda smiled. Tse Wen was a student of martial arts among many other things, but had the kind of mind that could apply those lessons to conflict with words and ideas. Here he had gotten the opponent going in one direction and effortlessly pulled him past his objective and onto the floor. But another reporter rose to take a shot.

"Dr. Zhau, is or is not the Ten-Ten experiment an attempt to create a black hole right in our own asteroid belt before final review of the project?"

"It is not. It is far too small, only ten milligrams, and not the right geometry, to create a black hole. Many years ago, it was thought that quantum black holes might form in such experiments, only to evaporate instantly. But according to the 2135 Wilson-Lu synthetic model of quantum gravity, the minimum area of an event horizon is approximately 1/720th that of a proton—far too big to be made with the amount of energy the Ten-Ten experiment provides. It should, however, help us calibrate Kremer's limit and understand what kind of phenomena to watch for in the main event. I should let Dr. Kremer describe the model."

Tse Wen gave her a cautionary glance.

"Less technical," she thought he meant. No escape this time. Hilda took a deep breath, stared up at great dark wooden beams, and imagined herself up there, calm and removed.

"Think of neutrons as tiny balloons filled with quarks," she began. "Squeeze them and heat them enough, they dissolve into a 'quagma,' a kind of bubble of free quarks buzzing around like angry bees. Push more, and the quarks buzz around faster and push back, but they get heavier and change in the process. At a high enough pressure, there's a transition to an ultra dense state of what we call 'strange matter' that is normally unstable, but can exist under extreme pressure.

"Increase the pressure and we think one gets a condensed Planck-scale Lu superposition of all the original mass. I say 'think' because by this time a stellar mass is so dense that it warps spacetime around it to the point where light cannot escape, becoming the unobservable inside of a black hole. The central pressure of a quark star of 3.18 solar masses is enough to cause that collapse.

"To make a black hole without a star, we need to force enough mass-energy into a small enough volume to exceed the critical pressure for long enough for the mass to implode within an event horizon. The Ten-Ten experiment will confirm the model where we can see it and help us with the precise design of the final experiment."

Hilda touched the net for Sarah. *I'm getting into your territory now, and you* like *attention.* "Dr. Levine?"

Sarah beamed and brushed a wave of thick brunette hair aside. "When we try to make the black hole some thirty years from now, we'll be using most of the interstellar propulsion capacity of four stars for several months. To use more would needlessly take resources from other interstellar commerce and exploration. Also, the resulting black hole would be heavier and harder to handle than needed. But if we use too little, we'd have to try again and decades of work would be lost. So to get it just right we're going to calibrate the model first."

The reporter frowned and looked as if he were searching for a follow-up that would make sense. Finally he just sighed, shook his head and sat down. Hilda almost sympathized with him; the poor man had been looking for something sensational or at least controversial and what he'd ended up with was "calibrate the model." Granted, it sounded sexy when Sarah said it.

"I think we should take one more question," Tse Wen said.

A well-groomed reporter stood up and stared almost accusingly at Hilda.

Torsten Ried, from Popular Issues, Sarah sent. *He's the brother of our nemesis, Senator Lars Ried. Watch out.*

Hilda bit her lip. Sen. Ried was the leader of the consolidationist coalition in the Interplanetary Association Senate and a frequent project critic. If his coalition got a majority, he could be the new IPA president. Hilda shivered. Consolidationists wanted to limit cultural change and typically opposed research that might cause it. If the demographic analysis of consolidationist gains was right, humanity might be in for as profound an inward turn as that of China a millennium ago. She might get only one chance to make a black hole.

Tse Wen acknowledged the reporter. "Mr. Ried?"

"Yes. Setting aside the uncertainties and the possibility of wiping this universe out with a new big bang, have any of you considered what you might unleash if you succeed? Are the leaders of humanity ready for the kind of power that having its own black hole would mean?"

Hostile as it was, Hilda realized it was a fair question. To her relief, Tse Wen nodded to Bradford Adams. Brad was a gifted engineer and practical problem solver. He'd thought and written more about what to do with a black hole, if they made one, than any of them.

"No problems, I think. Now our society lets people be people, so we still have gangs, power trips, and police actions here and there. But there has not been a war, or anything resembling one, among the advanced nations of the world, for over a century. Our cybernetic tools for monitoring and preventing misuse of resources are increasingly effective.

"Anyway, the black hole will be created six light-years from any concentration of human population. No bloody politicians there, just scientists." The audience chuckled. Brad's normally standard English lapsed into his native Australian dialect, or 'strine as he called it, when he got excited or wanted to sound folksy. "And many people *are* excited about this," Brad continued. "Even Bruce Macready, my old science history professor, wants in on it."

"The author of *Unification Quest*?" the reporter asked.

"Right you are. He's even offered to leave Broadfield College on the Isle of Skye to go along on the Epsilon Eridani mission as an historian. That's probably the most challenging star in the project, technically, because it's so young . . ."

Dr. Zhau held up a hand. "I must thank you all for this fascinating discussion. So fascinating that indeed we have gone a bit overtime and our food is waiting. Please, everyone, join us for the reception in the atrium and perhaps these conversations can continue in a more relaxed setting."

He bowed and motioned for the team to rise, signaling the end of the press conference.

Hilda and Sarah were first on their feet and quickly off the podium and out the door at the rear of the stage before the applause faded. They'd programmed the food and wanted to check on it. Sarah handed her jacket to a robot, revealing a dark, low-cut, strapless dress.

Hilda sighed. She hadn't considered looking any different at the reception than at the press conference, and her loose black tunic and pants, while simple and elegant, were about as unsexy as a nun's habit. Well, she thought, there was something to be said for truth in packaging.

They sampled some sausage and cheese; Sarah grinned and nodded.

Hilda touched the net to let Brad and Tse-Wen know they were ready.

The team lined up and the guests entered. After all the handshaking was done, knots of people formed. Sarah was surrounded by four major infonet editors, all male. Dr. Zhau had quietly slipped into a corner with the editors of *Scientific American* and *Nature* while Brad was sitting at a table in deep political discussion with some of the *Coriolis* media corps.

"Dr. Kremer?"

She turned. It was the reporter with the political point of view. She would have watch what she said. Misquotes by a journalist with a political point of view could be a real problem. "Yes?"

"Torsten Ried. *Popular Issues*."

"Oh, yes." They shook hands. Hilda forced a smile and focused in on him. He seemed normal enough, about 180 cm and trim. His slightly sun-bleached brown hair was short with a part on the left. He wore cologne, maybe a little too liberally for her taste.

"It's a nice spread," he said. "I detect a woman's touch in the programming."

She laughed. "Found us out, I'm afraid. Sarah Levine and I spent all afternoon yesterday on it."

"Dr. Levine, yes." Ried followed Hilda's eyes and did a double take.

"Well, I'd like to talk to her, but she seems occupied just now." He turned back toward Hilda.

"Off the record, there's some real risk, isn't there or you wouldn't be doing this experiment?"

Hilda thought about Sarah tasting her sausage and laughed. "It's just a calibration, a little like what Sarah and I did before this reception. The food was programmed down to the atom, but we still had to slip in and taste it first, to see what it was like."

He smiled disarmingly. "Isn't there any result that would cause you to give up the project?"

Hilda shook her head. "Black holes exist. The only question is how much trouble one needs to take to make one."

A deep, resonant *thud* broke the quiet. She wasn't conscious of falling, rather, the floor seemed to rise to strike her, fall away, and then clobber her again. Antique glass exploded into the room from the high windows. Wine glasses toppled to the floor and food dishes followed.

Smoke and dust filled the atrium instantly. People started to get up off the floor and head for the exits. Hilda sat where she was a moment, not realizing her mouth was open in shock until the dust began to tickle her throat. She tried to touch the net. *What happened?*

No answer. The building's comm must be down, she thought. She shivered. One got used to the near-instant access bioradio provided, and being cut off felt, momentarily, like suddenly being deaf, or in a lightless room.

"Dr. Kremer, are you okay?"

Hilda looked up at Ried's dust-covered face and clothes. "Ried? Yes, I'm okay. The local net's down."

He nodded and offered his hand, which she took and flowed up to her feet.

"Do you see Dr. Zhau and Dr. Levine?"

"He's okay—over by the buffet, I think. I'll see if I can find Dr. Levine."

Hilda found Brad and Dr. Zhau under the same table where she'd left them. Brad looked angry, Tse Wen looked calm but very, very serious. She felt another slight jolt then, and some dust came down on her. One look at the cracked wall towering over them and she slipped under the table between them.

"Aftershocks?" she asked.

"That was no bloody earthquake," Brad said. "I'd say it was a subterranean bomb and the cavity it created is collapsing—hard to believe that level of animosity. Fortunately, it was matched by their level of incompetence; the damage seems pretty superficial."

Tse Wen shook his head. "We should not assume incompetence, but rather that it achieved exactly the physical result they wanted. Now, what purpose would that result serve? It would frighten people. It could also serve to make the political opposition seem more moderate by comparison."

Brad nodded. "A good cop, bad cop ploy. Just another argument for them—see, we still have these fanatics and therefore we shouldn't have black holes. Machiavellian, it is."

Hilda shuddered, looked up at the table top, then over at Tse Wen sitting cross-legged under it. She did a quick calculation and smiled. "Well, I think we should have black holes. If we had a 16-billion-ton black hole on top of this table, Tse Wen, you could levitate!"

Tse Wen smiled. "Truly a demonstration to impress the greatest critic."

Brad laughed and put an arm around her shoulder; his body felt good next to hers, reminding her of the one night they'd spent together some twenty years earlier, when they'd gotten the go-ahead for the initial phase of the Black Hole Project.

They'd been at a conference in Lillehamar, Norway, talked impactor design and done simulations until the Sun rose at nine the next morning. Then, when the maid knocked and they realized it was getting near checkout time, Brad had held her hands and suggested that, as they were going to have the name for it anyway, they might as well play the game.

It had made her happy to make him happy. When she'd confessed to his girlfriend a year later, she'd gotten a laugh and a hug and the statement that boys will be boys. But there'd somehow never been another such occasion with Brad. Now, feeling him next to her brought back that the pleasant memory. She shut her eyes and tried to exist in the immediate moment, banishing explosions from her mind.

When she opened her eyes, there was Ried, staring at her as if registering something that hadn't occurred to him before.

"I couldn't find Dr. Levine, but I think we're in the clear," he said, relieved. "The net's back up."

With a nonchalant smile that she didn't feel at all, she extricated herself from Brad and under the table. The two of them helped Dr. Zhau to his feet. Maintenance robots were already whirring around, picking up the debris.

She touched the net, comforted by its familiar presence. No one had been seriously hurt, the damage was superficial, and the building would be usable again tomorrow.

"Well, Mr. Ried," Dr. Zhau said while brushing the dust from his shirt and pants, "do you know anything about who might be behind this?"

Ried shook his hear. "The Public Safety Administration puts the explosion almost half a kilometer under the institute building—it's as if someone loaded a mining mole with a half ton of chemical explosives. It was more likely intended to scare than injure."

"Really, mate?" Brad asked, his voice laced with irony. Did your brother tell you . . ."

Ried cut him off. "My brother's politics are his business. We're just half brothers anyway, and raised fifty years apart. I'm doing my best to be a reporter, that's all. But I think I can assure you that being connected with any kind of terrorism is the last thing he'd want politically.

Brad snorted. "Is that so? He wouldn't make danger from antiproject terrorists just another argument for shutting us down?"

There was an embarrassed silence. Hilda had never seen Brad so angry about something that didn't involve a steering magnet or a photon field lens. She reached for his hand and gave a light squeeze. *Let's not be too antagonistic,* she sent

Brad squeezed her hand back and took a deep breath. Then he offered a hand to Ried. "Sorry, mate . . . a bit shaken, it seems."

"Me too," Ried replied with a softer face and shook hands. "No offense taken."

Dr. Zhau smiled. "Well, Brad, Hilda, if things are back in harmony, perhaps we should check to see if our things are still on our shelves. The upper floors are cleared for reentry, it seems."

Hilda shut her eyes. Not surprisingly, her office cam was still offline.

Then it hit. "Cleared for reentry?"

Dr. Zhau shrugged and smiled. "I thought there would be less chance of injury in a fairly mild shake if we took cover here. Everyone else went out the exits. Afterwards, we were not missed, except by you. It appears we were not as important as the other events today might have led us to believe."

Sarah appeared. "Was I the only one here with the presence of mind to get out of the building?"

Brad started laughing uncontrollably. Soon they had all joined in, and the tension drained away.

Ried put a hand on Hilda's shoulder. "They've ID'd the group responsible for this mess. Another small fringe group I've never heard of that wants recognition. Dr. Kremer, I'd be happy to help you put things back in order. Of course I might have a few more questions over dinner afterwards."

Hilda saw the reporter's face lighten up. It seemed an earnest offer. Brad gave her an "it's okay" look.

"Okay, Ried," she said. "But only if you agree to call me Hilda. I've had about as much of 'Dr. Kremer' as I can take today."

"That," Brad added, "is another kind of Kremer's limit."

Ried smiled and stuck out his hand towards Hilda. "Torsten, then."

Zhau Tse Wen gestured to the stairwell.

Hilda sighed. The elevators would be down for a few more hours.

Dinner was at the Ridge House in North Boulder Creek. The meat was replicated, but the crepes and the soup were house-made and smelled delicious. The view sitting just above the pine tops was dramatic. At dessert, the fog rolled in below them like some kind of alien flood.

Knowing Torsten would eventually break the quiet mood with questions, Hilda ventured one of her own first. "Tell me what it's like to be in a political family. I can't imagine the pressures it must place on everyone around your brother."

Torsten chuckled. "No probably not. In my family, everything revolves around my brother's political career. He's the *Vaterführer*. Anyone can do anything they want as long as it doesn't get in the way of his vision for the family."

"It sounds a little autocratic."

Torsten shrugged. "It takes a lot of effort to put someone in office. You need a support team, and what better a team than a family. I'm kind of the black sheep in the family because of my independence.

"Quite a sacrifice, I would think," Hilda said, not entirely convinced of the independence or the sacrifice.

He shrugged. "Not for me. I always wanted to be a journalist. So I told them to leave me out of their political games. I just want to do my work the best way I know and leave the family politics out of it. You're Kate Avonford's daughter, aren't you, as well as Wotan Kremer's? That must have made for an eventful home life."

Hilda smiled wryly; she knew about living with famous parents. Her starship-captain mother and planet-molding father couldn't live with each other and couldn't stay away from each other, living a soap opera story that had spread to every human habitation in known space.

"Until I was sixteen; then Mom left and Dad sent me back to Earth to go to school. I had other ideas; I wanted to come right back, so I asked the crew to let me stay awake on the voyage and I studied on my own. I pretty much grew up on that starship; I learned to pilot on the ship's runabout, learned zero-g sports from the crew."

"Relationships?"

"No. The only ones up were three women and a couple of very married men who weren't interested." She shrugged. "I wasn't that interested either."

Torsten looked vaguely disappointed, and switched topics. "I see you don't have a school certificate or bachelor's degree?"

"No, just the Ph.D. I'd passed all the tests for entrance to grad school by the time I arrived and went right into research." She smiled, somewhat embarrassed." I've gone to some lectures, but never actually attended a regular class since leaving New Antarctica. So much for Dad sending me away to school!" She laughed. "At least your family's politics are external," she said. "You act like an objective journalist, but your questions seem, well, biased towards your brother's political bent."

"*Popular Issues* considers the consolidationist viewpoint a legitimate one. I try to ask the kind of questions my reading public would ask if they were here. Having a point of view doesn't make me unobjective or untruthful. Our readership has serious questions about what you folks are doing. My job is to address their concerns."

Hilda nodded, trying to understand his point of view. "I suppose every new thing ever done has been terrifying to someone. Automobiles—people thought human beings wouldn't survive 50 kilometers an hour. Now we approach the speed of light. Some thought these genetically engineered radios we grow in our heads were going to turn us into computer-controlled zombies; now they're so natural to us, we forget about them. Change happens. We adjust."

"Hilda," he said earnestly. "This black hole project is terrifying to ordinary people who don't understand it. It's just way out of anyone's intuitive range. I don't know if I can really explain it, but at least help me understand it."

She made herself smile and replayed the simulation she'd shown at the press conference on the restaurant table screen.

Finally he asked, "But a new universe is possible, isn't it? I mean, anything can come out of the quantum foam, can't it?"

"Look, according to statistical mechanics, every air molecule in this room might suddenly find itself on a trajectory toward the upper left corner of the room, leaving us in vacuum. Well, don't hold your breath."

Ried sighed. "Okay, I guess it's something I don't have to worry about right now. You don't mind if I use this interview on the net, do you?"

"Huh? How?"

"Watch the table screen. I'll play back the view from the restaurant's surveillance camera."

Hilda saw herself and Torsten from above, with the simulation on the tiny image of the table screen, looking for all the world like some weird place mat art.

"But what about privacy?" she asked. "How can you do that?"

"I'm licensed media, remember; I have access. We can use security video because otherwise everyone would be running around with cameras making a nuisance of themselves."

"I didn't know." She mulled over his revelation.

"Most people don't. As for privacy, we have to ask before using it, or lose our license."

She smiled as she saw herself talk and gesture.

"No problem?" he asked.

Maybe it was the wine, but she looked all right to herself. "No problem." Hilda laughed. "But, for the project information. Sarah's the key person right now."

"Does she understand it as well as you do? How do you work as a team?"

Hilda thought about that one. "We all work well together; Dr. Zhau asks the right questions, Sarah generates all the possible answers, I winnow the answers down to those that make sense and can predict something. Brad figures out how to test the predictions. Then Dr. Zhau and I go over everything that Brad does with anal-retentive thoroughness, and Sarah generates worst case scenarios—she has the most imagination. Occasionally, I decide whether a worry is real or not."

"But if some new theoretical concern came up at the last minute, you'd be the one they'd turn to, wouldn't you?" Torsten pressed. "They'd be reluctant to go on without you."

Hilda laughed and waved a hand expansively, "Okay, I'll admit it. I'm probably essential." Four glasses of wine, she thought, was what it took to let her say something like that. "It's getting late."

Torsten nodded. "Yes. But I'd like to continue this some day."

The conversation had been pleasant, Hilda thought, and the offer sounded innocent enough. "Okay, when and where."

"Well, I'm supposed to cover one of my quote brother's unquote speeches next week. Any chance you'd like to come hear it? Nobody needs to know who you are, of course. Then we can discuss it over dinner, on or off the record, as you like."

She did need to understand these people better. "Okay, it's a date."

They arrived at her car, the car door opened for her, and she flowed languidly into it. Torsten, grinned foolishly as he touched her shoulder, then let the door shut after her. She fell asleep on the seat as the car steered itself down the grassway and rocked gently as it caught the buried maglev track. Her last waking thoughts were that she was going to feel a bit silly the next morning, assuming some idiot with a bomb didn't blow her up for real because if she was really as important as all that, maybe the opposition would . . . do . . . something.

Chapter 2

The Hillside home of
Rolf and Anna Messenger,
Milbrae, CA, 12 April 2257

"Ever the daydreamer, eh?"

Torsten looked up, mildly irritated. He'd been working on the net—not daydreaming.

"Hi, Anna."

Anna Messenger, cousin Rolf's wife and a distant Ried cousin herself, was his hostess when he was in the San Francisco Bay area. She was tall, with straight auburn hair parted in the middle, and casually dressed in a plain gray long shift. When she moved, it was pretty clear that was all she was wearing. Such casualness, he knew, was sheer art—as an actress, she had learned how to gain advantage with men. An advantage Torsten had long since conceded to her.

He waved a hand in the air. "On the net, studying BHP simulations."

"Full access? How did you get by their blocks?"

"As far as I can tell, there are no blocks. No need. The explanatory text is in a foreign language—physics."

She rolled her eyes. "Come on inside, the fog's rolling in and I'm chilly. Any penetration?"

"I didn't get anywhere with Levine," Torsten said. "She's suspicious of me. But Kremer seemed less on guard. So I got her woozy enough over dinner, but she backed away. We may have the beginnings of a relationship, though. She's curious about us; she accepted an invitation to come to the forum next week."

Anna shot a glance at him. "Kremer? The black hole science geek? A wonder she'd let you get close. Levine looked more amenable to drugs and seduction. Kremer doesn't look the type. You think she'll really come to the forum?"

Torsten shrugged. "She says she needs to understand why we're doing it."

Anna spat. "Now you're swallowing *her* BS She more than anyone knows damn well that they're rolling the dice with everyone's lives—-and I mean everyone in creation—all for their own damn hubris. Torsten, politically, we need to get someone with inside credentials to say something embarrassing about the project. We don't have enough people scared yet. Did you get DNA samples?"

"We had dinner. I got her fork. What do you need that for?"

That got a wicked grin. "Opposition research. The less you know about it the better. Anyway, Lars wants to see you about your reportage. He's downstairs."

"Here?"

Anna shrugged. "I didn't think that was a good idea either. He insisted on coming with me."

As they came down the stairs, Torsten saw Lars and Mono Tukapo, his bodyguard and political secretary. Lars was actually shorter than Torsten, but so toned and barrel-chested that he looked bigger. His professionally styled hair was so neatly cropped that he looked more artificial than a humanoid robot. He reeked of the presence and self-confidence of a successful politician, and had for as long as Torsten had known him.

Torsten reached out a hand. "Hello, Lars. Something wrong with one of my stories?"

Lars flashed his best campaign commercial smile. "Hey, what kind of brother would I be if I didn't pester you once in a while? I'm worried that you might be doing the disinterested reporter bit a little too much, and thought we should have a chat. The polls being where they are, we could use a little more of a boost, and everyone knows *Popular Is-*

sues' lean, anyway."

Anna chuckled and ordered some drinks.

Torsten shook his head. Only a tiny handful of physicists really challenged the physics, and they did so in a language he couldn't understand any better than Hilda's. "Lars, I've got a reputation to maintain—my stuff is much more effective if I appear objective; a point for their side for every two of ours." To do even that much he had to be careful.

A robot floated in with the drinks. Lars latched onto one and sipped it as he stared off into space. Anna played with her ice cubes. It was clearly up to Torsten to fill the silence.

"Maybe I could go to three points for our side for every one of theirs?"

Lars shook his head. "No, if anything, get the ratio more even. AI's look at ratios like that and report bias. No, the points for our side need to be more telling, the ones for the other side more trivial. Present the issue in our language instead of theirs. Weight it that way. The public's not scared enough yet."

Torsten stifled a moment of irritation with Lars for telling him his own business—and worse, being right about it. He just nodded.

"Torsten, my committee is hearing rumors that the BHP is carrying on some secret experiments, even more dangerous than the Ten-Ten. We're not ready to go public with that, so it's off the record."

"Funny thing," Anna said. "The same things have been going around my production set. The studio is owned by Wu-Lake Ltd.; one of their divisions is the prime contractor on the experiment instrumentation—the stuff that's supposed to take quarter-nanosecond pictures of the Ten-Ten experiment until it gets vaporized."

Torsten laughed. "I've looked, and there's nothing there. I couldn't . . ."

"Sounds like you have two independent sources, Torsten," Lars said.

Was Lars crazy? The sources were hardly independent. "You want me to go with that?"

Lars settled back against his chair and made himself comfortable. "Torsten, there's a time for objectivity, but this election is about pulling in all the resources of our family to help win. It's not about individual pride, status, and reputation. No, this is about our people and what we can give back to them, what we can give back to our world. This election is about much greater issues than making governmental policies and keeping the constituency happy. It could be about saving humanity itself. We need to sell people on the idea that the public experiment is only the tip of the iceberg, that things are happening in the Black Hole Project that could destroy everyone if we don't expose this Ten-Ten experiment."

Torsten was silent for a while, contemplating his place in the family and the overall scheme of things. He had no choice. "Okay, you want a make-or-break issue to pull out of the hat just before the election? For that, timing is as important as content. You don't want to give them time to refute. Mark Twain said that a lie can get halfway around the world before truth has even put its boots on. We have to time it so the boots come on *after* the election."

Anna smiled at Torsten as if to say, "You're starting to enjoy this, aren't you?" "Well, we're stuck five percent behind. We need to switch two percent to you and another two percent of the expansionist leaners to undecided. Simulations show that a scandal on the Black Hole Project could do that, if it stinks enough."

Lars nodded. "Even the appearance of scandal, of stonewalling, or of something not entirely right could do it. Our side is the safe side."

Torsten sighed. "Okay. It's dueling experts and people-like-us can't decide. So, where there's smoke, there's fire. That will certainly bring in magazine hits; but . . ."

Lars cut him off with a wave of the hand. "This is the kind of gut-worry issue that binds voters together. Make them fear."

"As I said, it will be more effective closer to the election."

"Perhaps." Lars sighed. "We'll go with your judgment on that, for now. But make no mistake: this is a good cause to fight for. I believe in it. I'm told by some of the most brilliant scientists we have that existence itself is at stake here." Lars stopped for another dramatic pause, convincing enough that Torsten wondered if he might be sincere.

Lars continued quietly, "This is big stuff. So big I'm pulling in the whole family on this one. I need you. Everything might depend on a few good breaks."

"I understand fully, Lars, and I'm on it. I just have to be a little subtle, or it could backfire before the election." He didn't add that it was certain to backfire sometime after the election; that was irrelevant. If Lars won, he'd be in power and he knew how to use it.

Anna touched him on the shoulder. "We may need to do something to this Kremer woman before she does something to us."

"Journalistically, of course," Lars added.

"Of course," Torsten answered. "But, if I'm going to gain Kremer's confidence, I can't irritate her too much now."

Lars raised an eyebrow, then nodded slowly.

The day of the speech, Torsten watched Kremer walk into the Mark Hopkins Hotel. Her costume was pedestrian, a black tunic and slacks—indistinguishable from what she'd been wearing at the news conference. A typical geek, he thought. She walked closer to the inner walls, looking up, and she wasn't the only one. The bomb at the institute had left its mark on everyone's thoughts—even at a Lars Ried rally. Anna's friends had meant to scare people about the BHP but the immediate result was a kind of generalized fear that affected any potentially controversial gathering.

It was as if they'd let a genie out of the bottle, one that had supposedly been capped centuries ago. People were screaming for a review of antisurveillance laws and robotic restrictions. If Lars won, he'd probably get enough government policing power to prevent anyone from doing to him what his people had done to create the current mood. The irony of it made Torsten smile, however uncomfortably.

Kremer stopped and looked across the outer hallway through the transparent walls, a distinctive feature added in reconstruction after the 2221 quake. The view of the bay was one of Torsten's favorite sights, too. The only visible security was signs at the entrances that said "By invitation only," but the party's AI's would discreetly check everyone entering with multispectral cameras and microwave scans from overhead. Plainclothes operatives near the doors would be cued to offer gentle reminders to anyone who wandered in without reading the sign. Anna's work; she'd artfully arranged the appearance of openness and Kremer walked into the room unaware of the checks. Torsten went down to meet her.

She sat in the back of the room, running her hands through her short blond hair, clearly feeling uncomfortable. What would she know about Lars going in? He asked the net for a quick-look data scan to see what an outsider like Kremer might get. *Noted consolidationist within the Conservative Union Party—Geology degree—apolitical through grad school—gregarious—desire for order—politician since age of 42—drive for power came early—What did he want to be when he grew up? "'n charge," quoted from an undergraduate friend. Family home lies outside Leipzig* . . ." Nothing particularly scary there. He went up to introduce himself.

"Hello, Torsten. I've been reading reviews of your brother's political life. Some aren't very flattering—'unsophisticated,' 'a will to impose order,' and so on."

Torsten shrugged. "He's got a consolidationist constituency to play to. But beyond that, I think he's a pretty good leader."

"Is that your job, to balance the news?"

Torsten smiled and shook his head. For all her naïveté, this lady was quick—a lot quicker than he was, and he'd have to keep that in mind. He would have to work at his own pace and avoid getting into a contest of wits with her.

"I like to think I'm fair-minded about him, though. You know I don't know him as well as I should. He's more like a grandparent than a brother. Now keep in mind that he's preaching to the choir here. His job is to pump these people up and motivate them to go out and work for the election."

Lars Ried strode into the room and waved to the crowd amid applause and cheers. Dressed in a high-fashion single-piece navy-blue suit in the loose-cut Scandinavian fashion over a powder blue turtleneck set off by a red-jeweled medallion on a gold chain, he exuded urbane executive authority. Political posters rose up as if on queue as he took the podium. Lars nodded in appreciation and finally held his hand up to quiet the room.

"Tonight I would like to talk to you frankly about an issue that confronts each of us in this room and those I seek to represent. It is the undeniable and palpable suspicion, even fear, which divides the people of our planet today.

"Issues of pure scientific research that don't even have an economic value are dividing our world.

"Too often, those of us who believe in letting humanity adjust to the changes that technology has already made before embarking on new and questionable endeavors may, find ourselves caricatured and stereotyped as a danger to tolerance. Some have suggested that the Conservative Union Party is motivated by political opportunism with the ultimate goal of denying freedom to researchers, many of whom are doing the enriching and rewarding work of consolidating, understanding, and applying the huge mass of data accumulated over the last two centuries.

"My friends, the Conservative Union seeks merely to point out that the social and cultural implications of research can no longer be ignored. We say, let the people decide if they are ready for yet another new technology to complicate their lives. We say, let the people decide if they want to take the risk of playing around with the basic fabric of the universe when *there is no pressing need for it.*"

Kremer squirmed in her seat at the applause. Torsten patted her hand. Lars was in good form, Torsten thought, as the elder Ried's rhetoric flowed over its spellbound audience.

Kremer leaned over to Torsten and whispered. "I fear the beginnings of an inquisition."

Torsten put a hand on hers. "Not an inquisition; a regaining of control. This isn't the Middle Ages. The AI infrastructure can't be the instrument of an inquisition and it will defend individuals who resist it. An inquisition is impossible. Lars just wants efforts refocused. Politics is perception, Hilda. Yours are different from most of these people's. Hear him out for me. Then we can talk, okay?"

Hilda rolled her eyes and returned her attention to the platform.

Lars Ried continued. "I come before this audience tonight with the explicit purpose of reconciliation with the scientific community.

"Let us bridge together the gap of misunderstanding. Let us help the scientific community understand that humanity is in danger of losing itself and cannot afford the disruption that the Black Hole Project might bring. Enough is enough."

"You call that reconciliation?" Kremer whispered to Torsten who winked back at her.

"History has much to teach us about scientific research run amok," Lars continued.

"Friends, just as we have citizen oversight committees guiding our legislation, we need citizen oversight committees watching over scientific research projects. Even if they may be right, we have to hold back until at least a majority understands what they are doing! It's our necks on the line.

"My first priority if elected will be to put at least a temporary hold on any other experiments that may have societal implications, including, on the face of it, the Black Hole Project. My second priority will be to put in place a citizen watchdog committee to curtail aberrant research earlier. The expansionist coalition is on record opposing both initiatives. The choice of responsible people should be clear.

"Thank you for your support!"

The resulting ovation rang in Torsten's his ears. Kremer sat shaking her head and looking distinctly unhappy.

"It's all about power, isn't it?" she said. "Who is the alpha male? Who gets to beat on whom? Your brother reduces the work of the entire scientific community, never mind the Black Hole Project, to a political beauty contest, with him and a bunch of politically correct toadies as the judges."

He winced at "toadies" and the hostility it implied. "I'll ignore the moral issue for the moment, but at least consider that it is simply impossible for a democratic politician to pander only to elitists and stay in office."

"Elitist? Look, I don't know the first thing about, say, hypnoactive kinetic art. Does that make the artists 'elitist?' It's just different areas of interest. Leave cobblers to their lasts."

Damn, she was bullheaded! "When the last is creation itself? I think not."

"But . . ." She seemed confused, and a bit angry. "You journalists can affect so many things yourselves. Are you really objective, or is that just a power trip, too? Excuse me a moment."

She whirled and walked off toward the toilets.

Torsten waited by the hotel foyer. He wondered once more if she was angry enough to duck out of their dinner date. But Kremer returned, noticeably more composed than when she left.

"I hope this doesn't mean we have to postpone dinner . . ." he began.

She shook her head and smiled fleetingly. "I'm fine."

They wandered downhill in silence and ended up, not so accidentally, at a small Thai restaurant Torsten knew. An elegant little hideaway on the third floor, it had leanings towards the exotic spices of Pattaya—served, of course, by elegantly painted young men dressed in stunning silk dresses. He'd taken dates there before, often with good effect.

Kun Srichard, who knew the Ried men well, provided Torsten with a table in a quiet corner of the petite room with a secluded view of the ancient Golden Gate Bridge sinking into the fog, now rolling in from the ocean.

A message from Anna announced itself as they finished a dessert of candied rice and fruit. He touched the net for the playback.

Good news—they've got problems with the experiment. Your sweetie doesn't know it yet, but she's going on a space voyage. So are we.

We? Space? he replied.

I'll tell you all about it when you get here.

His heart beat a little faster than could be explained by the curry.

Chapter 3

Dr. Hilda Kremer's office,
BHP Headquarters, 15 April 2257

Brad's image on Hilda's wall screen

pointed to a section of the array imaged on the wall screen of his office. Hilda thought briefly of the nesting of images of ever-decreasing size and resolution collapsing to a precisely located point with no information content.

"If those radiation levels are isotropic," he said, "the experiment is putting out more energy in gamma radiation alone than we are putting in with kinetic energy." He turned to her. "I don't buy that, but I don't see how the results could be strongly directional. We've only collided milligrams; not nearly enough for any shielding effect."

Hilda shook her head, feeling frustrated; the results made no sense and screamed of bad data or bad instrumentation. But, she reminded herself, much great physics had come from results that were contrary to all expectations, at first. "Brad, even in these precursor collisions, we're into new territory; quagmas a million times denser than have ever been produced before. We ought to expect something new."

"I know," Brad said. "If we only didn't have the whole bloody world breathing down our necks expecting everything to be perfect and just like predicted or else. I look at the political sims and wonder if there will ever be another chance." He scratched his right temple.

"I know how you feel," Hilda said. "Bombs, grandstanding politicians, idiot journalists . . . I didn't think it would be such a fight," she said. A pang of guilt joined her frustration. Dating Torsten Ried and getting a worms-eye view of ultra-suspicious populism and its panderers had given Hilda lots of insight into the political problems they faced. In the last two weeks she'd seen political networking that put even academic kingdom-builders to shame. On her own part, she'd offered her services to the project's outreach group, talking to high schools, futurist groups, and even a journalist's convention.

Torsten, to his credit, had introduced her to several journalists who at least had an inkling of how the scientific community worked and encouraged her to reach out to them, while cautioning her not to voice too many technical words. But, outreach sucked away her time and energy. She hadn't touched her toroidal spin web transformations in two weeks and felt a growing void within her.

Brad snorted. "It's a bloody law of nature; the bigger the advance, the more you have to fight for it. But we have to stay with it. You'll be able to concentrate a lot better when you get out to the test site, away from these distractions."

"Is that why Tse Wen is sending Sarah and me out?"

Brad shook his head in frustration. "I'm not sure what you two can do to the experiment on-site that you both can't do here. But she'll be a right place to think."

"Well, we're sure not getting anywhere here," Hilda said. "So maybe being there will work—just seeing the stuff with our own eyes and touching the equipment with our own fingers."

She recognized Tse Wen's wisdom in sending them to the experiment site. They needed focus, focus away from this political mess. But frustration crowded into her thoughts. She turned to her long-time friend. "Thirty years of work and things feel like they're coming completely unglued—bombs, Lars Ried's political pandering, crazy experiment results . . ." She sighed. "It's getting late. Talk to you later. I'm going to sleep." Hilda often stayed overnight and slept on a fold-out cot. She pulled it vigorously from her closet.

Brad smiled. "Oh, she'll be right in the end, you'll see. G'night."

The screen went blank.

Chaos, I just hope I can sleep, she thought as she threw her clothes into the closet.

Morning was bright in her window when she realized she hadn't thought about black holes, quantum gravity, or protesters for at least eight hours.

She took that thought back—she hadn't thought of it *consciously*. But from somewhere in her deep sleep at least three plausible explanations for what had happened had formed in her head. Smiling, she sat down at her terminal, grabbed her sketch pad, and started setting up the simulations.

Her stomach growled. She was, she noted, still stark naked, and ravenously hungry. Time for a break. But plausibility started to change to possibility before her eyes, and she kept on. One of the possible explanations might mean that the darker side of Lars Ried's political constituency had penetrated into the project far deeper and with much more sophistication than any of them realized.

She sent a note to Tse Wen and grabbed her long shirt in case he called back.

He did.

"I was wondering if we might have lunch. There are things I'd like to talk to you about—in person."

"I am available," he said with a smile.

Tse Wen stroked the slight goatee he affected which, along with his bald head and thinness, gave him the aura of an ageless oriental sage. He'd been about forty when the antiaging retrovirus was spread—it was all for effect, which he'd cheerfully admit if called on it.

"Now what is all this being mysterious about?" he asked.

Hilda's hamburger was too good to believe. Grill smoke leaking into the dining room of the cafe added to the taste of the food without being overly noticeable. She swallowed her last bite and had a sip of lemonade to clear her throat.

"I see three possibilities for what's happening at the experiment site. One, of course, is that it's new physics—perhaps a virtual quantum black hole did form and there was a kind of leakthrough of energy from another universe, or another part of our universe."

Tse Wen nodded politely. He didn't think so either, she could tell, but completeness required mentioning the possibility.

"The second is that the anisotropy is caused by advanced wave Mota crystallization."

He frowned. "General relativity permits such a solution, but I think that is only because it is incomplete. Even at the Planck level, the causality implications are disturbing."

"Aren't they? I can't say that there aren't any other possibilities for anisotropism, but that was the only one I could find that made even that much sense. Which brings me to my third idea." Her face sobered. "Maybe we aren't getting the real data."

Now Tse Wen really frowned. "The last thing a theorist should do is to claim that data is bad which does not fit previous theory."

Hilda nodded. "That's why I mentioned it last. But the falsification of data does fit within the existing theoretical structure, perhaps better and more simply than time travel or multidimensional teleportation."

Tse Wen shook his head, then grinned. "I would not put out press releases. But you have convinced me some caution is warranted. I shall have conversations. Do you still see the reporter, Torsten Ried?"

"Occasionally."

"Do you think that wise?"

Hilda ran a hand through her hair. "Torsten's a nice guy. Lovely smile, and he thinks and listens. I'm making progress; he's not certain that the Black Hole Project is such an evil thing, he just doesn't know and he's got a lot of family pressure. And you know, I'm not sure Lars sees it as anything more than a political issue that he can use to play his political game. If it became a non-issue, or even worked for him in some way, I don't think he'd bother to oppose it. I think we just have to do a better job of educating people."

"Ah, very brilliant! After a few years of such an education program, the proportion of people who tunnel bombs under our building may decrease by a statistically significant amount!"

Hilda felt deflated. "I'm sorry."

"And I, too, am sorry for using humor to disguise my frustration, which is as great as yours. I shall trust you and Sarah to deal with any possible physical causes of the anomaly, in the distraction-free field location. Brad will continue to supervise the work here. It will be left to me to talk to people to try to bring things back into harmony again. I think next year, *you* should chair the project."

Nobody had ever said or done anything to scare Hilda as much as that pronouncement. It left her open-mouthed and staring at Tse Wen in abject horror. She could not think of anything to say.

Tse Wen laughed and reached out to touch her. "No, no, I was only kidding."

Hilda began to giggle a bit in a reaction that soon dissolved into the kind of uncontrollable laughter that was for her but a micrometer from uncontrollable tears.

"You'll need to go soon. Your certification is current?"

Hilda nodded.. One of the results of being awake for eight years on a starship was being a qualified spacecraft commander.

"You can work out the details of the investigation on the *Psi Naught* en route.

It took a week to get clean up loose ends and get underway, but once the *Psi Naught* finished acceleration and settled into the routine of interplanetary travel, Hilda buried herself in simulations, changing parameters and discarding approximations in an effort to make theory fit the data. She came up only to eat and sleep. For her, this was what physics was all about—the driving compulsion to work through a compelling problem.

Three days after they departed, Sarah came to Hilda's cabin.

"Any luck with the theory?"

Hilda shook her head. "If those results are real, they don't fit theory. But the main data-handling software seems very clean"

Sara frowned "I think we can verify the anisotropy question by placing new Ragi probes away from the collision plane and firing another round of tests."

Hilda nodded. "That leaves bugs in the data stream itself." A century or two ago, spy services developed a very thin technology that could be inserted in a fiber optic cable joint. The bug could read data and pass it on with or without modifications.

"The controller would have to be very sophisticated, possibly even a non-Asimovian AI," Sarah said.

The idea of an AI not limited by the laws of robotics disquieted Hilda. "Chaos, these people have blinders on if they'd do that!"

"You've seen them in action. Using an illegal AI would be exactly what Consolidationists should be against. But power is what they're about, not principle."

Hilda shook her head. "They'd undercut themselves if it ever got out. Too big a risk, I think."

"So maybe they think that we wouldn't be looking for it," Sarah said. "Anyway, the Rieds aren't the whole story. The project is a big target. There are other more fanatic Consolidationists and people who need to make their own mark on the cosmos. They could do anything."

"Our AI's should help us against that kind of threat."

Sarah shrugged. "They'd try to protect us, but remember that our opponents are people, too. Typically Asimovian AI's stay out of people conflicts until physical harm to someone becomes a real possibility, whatever their evaluation of the potential perpetrators."

"I'm not sure I'd want to change that," Hilda said after some thought.

"Me neither—which is why we have some work to do ourselves, and quietly." Sarah stood up. "I've got the equipment ready to go. My thinking is that we should get it in place first thing before the opposition figures out that anything is happening, let alone what."

"Okay." Hilda nodded and smiled. "It's been a while since I did anything experimental. I may be all thumbs."

Sarah smiled. "We have time and a fully equipped nanoscale fabrication facility on board."

Six weeks later, Hilda watched the fountain of glowing plasma corkscrew ahead of the *Psi Naught* as the ship decelerated toward the main habitat for the Ten-Ten experiment personnel. Her weight fell as magnetic fields transferred the spacecraft's spin angular momentum to its exhaust.

As the rotation slowed, she could watch long enough to follow the long white tubes of the Ten-Ten experiment's pellet accelerators all the way in either direction from the Macrocollider Experiment Station. The faded to the thinness of spider silk but never quite vanished, even ten thousand kilometers distant. The beauty of it never ceased to thrill her.

The project's cylindrical habitat and control center swung tethered to an asteroid about ten kilometers from the planned collision vertex. The complex seemed to grow as they got closer and she watched the cylinder of the habitat module swing around its asteroid anchor once a minute like the second hand of a giant clock. A tiny elevator climbed inward from the habitat to meet them at the central rock.

The plasma fountain ceased as the *Psi Naught*'s relative velocity decayed to a few meters per second. Hilda and Sarah felt a momentary queasiness as they returned to zero gravity. Hilda took personal control of the spacecraft docking for practice, goosing this thruster and that to bring them to the counter-rotating dock assembly at the north pole of the little asteroid. There were three other spacecraft present, including the Interplanet News ship, *Gulliver.*

"I thought we were going to get away from that," Hilda said.

Sarah shrugged.

As she settled in among three other spacecraft, Hilda watched insect-like limbs deploy from a half dozen places around the *Psi Naught's* toroidal hull and grasp the open latticework of the docking platform. A flexible tube rose like a cobra from the platform and mated itself to the main door of the cabin. Sarah supervised the shutdown.

"Your helmet." Sarah handed Hilda her helmet with a slightly defiant look. The chances of her needing it were about as close to infinitesimal as any AI could calculate, but Sarah liked all her stones turned over.

Hilda laughed and took it. "I feel like I'm headed for another giant leap for woman-kind instead of a docking tube."

The entrance into the air-filled docking tube was as normal as ever, though, as was the trip down the elevator to the habitat cylinder. There was a surprise when they got there, however: Torsten Ried

"Uh!" was all Hilda could manage.

"Mr. Ried," Sarah said, drawing out the "Ried."

"Torsten, we're going to be kind of busy," Hilda said, apologetically.

He nodded, but looked at her more like a puppy than a predator. "Don't worry, the media room's on the *Gulliver*. We'll all be there, anchoring, when the thing actually happens. Besides, you don't have to work all the time, do you? Dinner's being served in the level six atrium now. That's where everyone is."

His questions over their last meetings had been getting less and less hostile, and their conversations had ranged over the known universe, from Hilda's memories of New Antarctica to the debate about the genetically unmodified New Reformationist colony at Proxima II. Hilda felt repelled at the loss of life and Torsten listened; he'd been a good listener.

Hilda nodded. "Good. We'll be up after we get settled in. I didn't mean to be cold, Torsten. It was just, well, a surprise."

He laughed. "That was the general idea. May I offer you a tour?"

Sarah waved him off. "We spent a year out here helping set this place up."

"Oh. Well, okay, I'll see you ladies later."

The walk was a pleasant stretch. Hilda reviewed the layout on her net to locate their assigned quarters. The can was about thirty meters in diameter with staterooms arranged in rings around the outside of each of the first nine levels. The center sections were given over to equipment, labs, and common functions. There were three elevators spaced equilaterally. The tenth level was a domed combination of park and vegetable garden, with a swimming pool that Hilda had been dreaming about since the *Psi Naught* shipped out. The corridors were lined with hydroponic flower boxes as well; a thornless yellow rose with just enough scent adorned either side of her room, Number 502. Sarah was in 503 next door, with petunias.

Later, they went through an uncomfortable dinner in which almost everyone was either a media jackal looking for meat or a potential saboteur.

Hilda took Sarah's arm. "I'm not sure I can take another one of these."

"I know how you feel. Ready?"

"You mean, just go and do it? Now?"

Sarah grinned. "Now."

They wandered out of the cafeteria separately, then checked out a shuttle and arrived at the MES at 2300 universal. The ten-meter-radius sphere of the Macrocollider Experiment Station was so covered with various protuberances, antennae, and boxes that it looked to Hilda as if someone had dipped a gecko-covered volleyball into a bin of miscellaneous electronic parts. Formally, it was called the MES, informally, the "mess." Their shuttle headed for a tubular protuberance that turned out to be an airlock. They docked.

Pressures equalized, the doors opened.

The spherical room was brightly lit. Narrow boxes, tubes, and lattice frames radiated from the very center of the complex like an outsized metallic forest growing from the tiniest asteroid imaginable—a one-meter radius ball. It looked like random junk. But a second look showed Hilda that the long axes of most of the equipment lay in a circular plane centered on the vertex, as they should be to investigate a sheet of debris normal to the collision axis. Black patches of photovoltaic cells and infrared data bus windows glinted on most of the equipment.

Hilda examined one of several huge boxes around the outer wall of the sphere and found what she was looking for. "Sarah, here's the neutrino detector. Neutrino radiation from the experiment *should* be approximately isotropic and proportional to the total energy. Let's see if this one is telling us the truth."

"Got it," Sara said, and shoved herself over to the device.

Meanwhile, Hilda placed a number of simple, disk-shaped neutron detectors, each about two centimeters across and a couple of millimeters thick, at various places around the collision site.

"Good evening, ladies," a voice announced.

Hilda felt a chill down her back.

She turned and saw a large ruddy man wearing a BHP staff sweatshirt glide out from behind the central globe. He was calm, inexpressive, neither smiling nor frowning, but his eyes darted restlessly.

"Good evening," she said. "You are?"

"Dr. Vitaly Rossov, Dr. Kremer; I am new site engineer. Anything I can do to help?"

Sarah stopped her with a hand on her arm and smiled at Rossov. Hilda noted that the front of Sarah's skin-tight pressure suit had opened almost down to her navel.

"Nothing we needed to bother you with, Dr. Rossov," Sarah said. "We're putting some equipment in place for tomorrow's test shots and adjusting camera fields. Trying to get a handle on the anomaly."

"I'll be about my calibrations then," he said. "We have a test shot at 0900 and everything should be ready. Not expecting visitors. Will be done in hour or so."

"We'll manage," Sarah said. "Thanks, Dr. Rossov."

Rossov nodded and floated back to where he'd come from.

Sarah made a hush gesture to cut Hilda off, then pointed to the terminal end of the neutrino detector cable on the outer wall of the facility. "Hold that," she whispered, positioning Hilda so her body hid the work site.

Sarah, Hilda decided, really didn't trust Rossov.

Silently, Hilda held the cable, floating so her body hid what they were doing while Sarah slipped the tiny, transparent disk over the optical cable end and reconnected. Then she followed Sarah to the airlock and the shuttle.

"Is Rossov a spy?" Hilda asked, in the privacy of the shuttle.

"Someone is," Sarah said. "He gives me the creeps, so that makes him a suspect. He's also in the right place. "If Rossov were working for them, he'd know how to fake it. I'm going to set an agent watching with an radio link back to the *Psi Naught*. If there's any tampering, we should see it."

Everyone gathered in the habitat auditorium to watch the data come in from the shot—staff, investigators, and press. Sarah wore a thin T-shirt and loose, clingy shorts—artlessly practical in the warm controlled temperature of the habitat, but Hilda thought it made her look like a teen age pin-up instead of one of the top physicists in the solar system.

Hilda wore a much more dignified plain black jumpsuit and had her vacuum tights underneath, in case they needed to go to the experiment site on short notice. What an odd couple we make, she thought. Hilda found a spot next to Sarah, then Torsten Ried planted himself next to them.

"Morning, Hilda! Hi, Sarah."

"Good morning, Torsten," they said, almost simultaneously, and with about the same weary inflection, then laughed.

He smiled. "Yes, uh, what are we going to find out new today?"

If we knew that, thought Hilda, we wouldn't be doing the experiment. But be nice, she told herself. "For one thing, we'll be able to put some limits on anisotropy and get a better idea of radiation losses."

"Anything that would detect the beginnings of a new universe?"

Some people, Hilda thought, had one-track minds. She shook her head.

"T minus three minutes and counting," the experiment control software reported.

She scanned the situation display. A green color raced down the two beamline representations, indicating that the accumulators for each set of coils along the line were fully charged, each coil ready to come on at the appropriate time to push the pellets ever faster.

The count reached ten. Torsten, she saw, looked confused. Too bad, she thought, I'm not going to launch into a lecture now.

". . . 3, 2, 1, fire."

The green lights went off down the line at an accelerating rate until they were all off.

"Good shot," the controller reported.

I don't believe this, Sarah sent. *It's completely nominal. Hilda?*

Hilda was already comparing the readings from these instruments with those reported on the previous shots that had brought them out here. The anomaly had vanished entirely.

Nothing, she reported

"It looks completely nominal so far," Hilda said aloud.

"So far?" Torsten asked. "What does that mean? Why wasn't it like the first shot?"

Hilda stared at him, searching for words. She was not, she realized, ready to accuse nameless parties of falsifying the experimental results, even though that was what had clearly happened.

"Something in the instrumentation setup itself may have caused the first set of anomalous readings. That's the only thing that's changed."

"An observer effect? Like Schrödinger's cat—half dead and half alive until someone looks?"

Hilda groaned. "No, we physically moved the detectors. Besides, it's not 'half,' it's a superposition . . ."

"Excuse me, Mr. Ried," Sarah said. "Hilda and I need to have a chat. In private."

"You're in over your heads, then, aren't you?"

Sarah smiled. "Not exactly, Mr. Ried."

Hilda followed Sarah, but instead of heading for their rooms, she headed for the airlock. Hilda smiled to herself—when Sarah said private, she meant private. Fifteen minutes later, they were outside gliding over the small asteroid's surface near its center of rotation, with Sarah trailing an emergency survival pod along. Sarah said nothing for a while, but appeared to be looking for something. Finally she motioned for Hilda to follow her. Then, amazingly, Sarah seemed to vanish straight into the ground.

It was a cave entrance, Hilda discovered, as she got to where Sarah vanished. "Sarah?"

No response. The asteroid had a high nickel-iron content, though, and might be screening Sarah from her radio. There was no other cave entrance around, so Hilda gulped and pulled herself in afterward. It was pitch black.

"Sarah?"

An intermittent signal light started blinking on the display reflected in Hilda's helmet faceplate. As her eyes adapted to the dark, she began to detect a very dim glow and smiled. She activated her own suit lights so she could follow the passage, and in a minute was floating next to Sarah in a small, roughly spherical room.

Sarah put her helmet next to Hilda's.

"I think I know who," she said.

"Isn't this getting a bit melodramatic? I almost didn't follow you in here!"

Sara laughed. "We might be bugged. The station net might be bugged. If your radio signal couldn't reach me in here, then the signal from any bug can't get out. Now, help me with the vacuum tent."

The two-person emergency tent was a tight fit, but they managed to wiggle inside and inflate it. As soon as the pressure was up, Sarah made a hush sign and started to take off everything, motioning for Hilda to do the same.

Their clothing might even be bugged, Hilda realized.

They pushed their clothes into a pallet, and sealed it. Donning the emergency gear, they deflated the tent, and pushed the pallet out. Then they reinflated the tent.

"There's no reasonable theoretical explanation for this, is there?" Sarah asked.

Hilda thought hard, giving that question a lot more effort coming from Sarah than from Torsten. Maybe she owed him an apology. "The results are inconsistent and the second set are the right ones. It's Rossov."

Sarah nodded. "Besides, he may have intimate connections to the Ried family; he had an affair with one of the cousins, someone named Anna, years ago."

"Sarah, that's personal data. How did you . . . ?"

"Pillow talk."

"Sarah!"

She laughed again. "I got it from Irene Simmons, who has odd tastes in men.

Anyway, Rossov tends to brag after too much vodka. Years ago, he studied voice in Nürnberg then and appeared in a low-budget opera. Our Anna was the only Ried of the right age in the area at the time. Rossov was not a very good basso, but a really clever set designer. Later he got a Ph.D. in physics, but had problems with getting published and ended up in instrumentation. So we have professional jealousy and a sexual connection."

Hilda pondered this. "We can't let everyone know about the telltales or the bad guys will know, too."

Sarah nodded. "So we've got to play it like we don't know. With a couple more tests, we'll have enough information to argue convincingly that the anomalous results aren't real. Or, we might catch him tampering again."

What a tangled web we weave, Hilda thought. But Sarah was right. "Okay. We can go ahead with the Ten-Ten without Rossov being aware that we're onto him, but we need him out of the picture before he can think of anything else to screw it up. Doesn't anyone have the authority to simply remove Rossov, without making explanations?"

"Tse Wen could, which I think he will, if we have data to convince the personnel review board," Sarah explained. "With Rossov out of the way, all we have to worry about is physics."

Hilda bit her lip. The election was less than a week away, and the Senate's control of the vast resources for the project was at stake. "What if Lars Ried becomes president?"

Sarah shook her head. "That's another worry. One more thing—we can't talk about this to anyone where they can plant microbugs. Rossov is good at this kind of thing. The net here is his, so he can defeat that encryption, too. If we use another encryption, he'll think we're onto him. Nix on the net chat, too. Just in case. But we can bring dates here."

Hilda groaned. "Sarah, I just want to do physics."

Sarah grinned. "I'll take care of the dating part. Let's get back."

Chapter 4

BHP Solar System experimental station,
1 June 2257

Hilda, in the holographic simulation room, found herself biting her nails for the first time since she was a teenager. The experiment itself was not the source of her nervousness. Three more runs at the milligram level showed no anomalies, and they got the go-ahead to do the Ten-Ten experiment—only two days before voting began in the senate election. The opposition was certain to do something, and there was no time to recover. She filed a final prediction run, leaned back to stretch, and saw Torsten Ried enter.

She fought irritation; there were no rules barring media from the work areas, but by a kind of implicit mutual consent, the physicists were allowed to work undisturbed in those areas. "We've got company."

Sarah sighed softly. "I noticed."

"Hilda, Sarah," Torsten said, "sorry for the intrusion, but we've got nineteen-plus hours of virtual dead time to fill until you fire the Ten-Ten experiment, and I wondered if you'd help with a piece out at old Duluth Station—what things were like before the new facility—Captain Sally Duluth slept here and so on."

"Can we wiggle out of it?" Hilda asked Torsten. "There's still stuff to do."

"You're not completely ready?" Torsten suddenly seemed very serious.

Sarah shook her head. "We're more than ready enough, but we can always squeeze a little more out of the shot. Hilda, I have things in hand if you want to go."

Hilda nodded. Sarah was essential to their plans and having Torsten elsewhere would be a good thing.

"It won't be long," Torsten said. "I think we'll need three hours on site at the outside. We'll have her back here watching the MES eight hours before T = 0."

Hilda noted with a smile that, after a week out here, Torsten was calling the Macrocollider Experiment Station "the mess" and talking about "T = 0" like everyone else. "Tse Wen thinks it's a good idea to be as open with the media as we can and cooperate in every way possible. 'The silence of many hands not clapping is louder than the sound of few cheers,' he says."

Sarah sighed. "They won't applaud what they don't get. You've had practice with Torsten, of course."

Torsten smiled wryly and spread his hands as if to say that was simply the reality of his business.

Hilda shook her head. There were, she thought, people all alone in kuiperoid stations a thousand astronomical units from nowhere perfectly happy with research problems that could be done with one mind, a good cybersystem, and no interference. Why, she asked herself, had she chosen something so public? Or had it chosen her?

"Hilda?" Torsten asked, and smiled. "You look frustrated."

"Just working things out." In spite of everything, the man still attracted her. A challenge? A response to the special attention he paid to her, even if it gave her a headache at times?

"Okay, I'll do it." She smiled at Torsten. "I'll meet you at the shuttle port in an hour."

As they approached Duluth Station airlock, Torsten asked, "I hear your father's back on New Antarctica and Tse Wen wants you to go back to head up the project there."

Hilda looked at him quickly. "Word travels fast. That wasn't supposed to be announced until we finished up the Ten-Ten. I haven't really decided. There are still some issues between Wotan Kremer and me. That's off the record, though, please."

Torsten shrugged. "Don't worry. We'd just say you were weighing it."

Hilda nodded curtly. To give her mind something else to think about, she took manual control of their approach and swooped in on the shuttle's belly thrusters, pinning them to the floor with a gee and a half while the AI squawked helplessly. At the end of it, she kicked in the minus-x jets for a hard two seconds of eyeballs-out to leave them floating dead in space above the docking mechanism.

"Jesus!" Torsten exclaimed, looking green.

Hilda laughed. "I learned to drive on a starship's runabout, Torsten. It's what we do for recreation out here."

Once secured, they made their way to the lock. Hilda was almost into the tube, before turning back for her helmet. There was no net here, but it felt almost like Sarah was sending her a message. At the Station entry lock, stowed their gear and headed for the old command center beneath the port area. Hilda floated over to a console and let microgravity bring her body into the footholds beside it.

She chuckled. "This is more advanced than it was in Duluth's day, but it seems primitive," compared to what we use now."

Torsten looked at a bank of dead gray touch screens, wondering. "Can you explain what's changed in language people can understand?"

She felt irritated for only a moment. "I can try. This panel controlled a millimeter-wave system; we could punch straight through an atmosphere with that, but the data rate was a millionth of the multiplexed x-ray frequencies we use now. Also, at the higher frequency, we can focus to a spot a million times smaller with the same size aperture at the same distance. That helps with the BHP's interstellar com."

"That's done from here?"

"About fifty kilometers away."

"So right now, even though the project hasn't been approved yet, there are messages going out toward Groombridge 34, Epsilon Eridani, and, uh . . ." Torsten hesitated.

". . . Lacaille 9352," Hilda filled in, "and Chandresekhar Station at the BHP's vertex. The power systems being built there will be used for interstellar exploration, commerce and settlements as well as for the Black Hole Project. This project requires a lot of lead time."

"You seem to have a great deal of confidence. Uh, zero gee is getting to me. Where's the . . ."

Hilda smiled. "Door three, then left."

Alone, she glanced around the room, remembered, then wondered what it would be like to remember it a million years from now, or a billion. The BHP was not the culmination of human history, she realized, but part of the beginning.

A dark, space-suited figure floated into the room and raised a spray can, which hissed. *Sarah* . . . There was no net in here. It got very dark as she fell slowly in the minuscule gravity.

"Mr. Ried, Anna sent me," a low, slightly Russian-accented voice announced when Torsten emerged. It was Vitaly Rossov, the site engineer. He wondered what the man's relationship was to the family. He held out his hand.

"Why are you here?"

Rossov tossed him a duffel bag. "EVA kit. Put it on. I have something to show you. Channel ten."

Torsten complied and accessed channel ten in the suit's comm system. A star field filled his heads up display. An arrow indicated one of the stars. A dim asteroid was moving toward it.

"Electing Lars is plan A. This is plan B. Arrow points to New Antarctica from Groombridge 34 antenna five years from now. Asteroid, we have just given a slight push, to cause an occultation."

Groombridge 34 dimmed and vanished for about thirty seconds as they watched. Then it blinked in again

"How does this help anything?"

"When eclipse happens, we substitute our own message for a couple of milliseconds, in dead time before cut off. Then, fifteen years from now, the Groombridge 34 impactor has a new launch time. Wrong launch time. Clever, yes?"

Torsten nodded dumbly. Somehow it didn't seem fair. What possible good it could do Lars here in the Solar System? Well, he thought. Maybe it wouldn't work.

Rossov powered down the console to standby condition, then handed him a data stick.

"Codes. In case I am incapacitated, and the backup is not needed. It could give us away, so it shouldn't be used unless nothing else works. The AI inside knows what to do."

Torsten grimaced, wishing someone else had that mission.

Rossov put his helmet on and turned up the visor reflectivity. "You wait here."

"But Dr. Kremer . . ."

"She will join us shortly. You wait here."

The first thing Hilda noticed as awareness slowly returned was that her head ached. She groaned and stretched. Then she remembered where she was—someone had done this to her. You should pretend you're still out until you get your bearings, she thought.

Too late. The figure with the spray can was in the room and headed for her. It had been six decades since she'd done any zero-g wrestling—but the fact that she'd done it at all might be an advantage. She took a deep breath, moved her legs against a nearby wall panel and with a quick movement, shoved off from the panel and lunged at him. He reached for her, but she caught his arm, pulled it by her, and wrapped herself over his back, starfish-like. The two tangled bodies cartwheeled toward the door while the spray can went flying across the room.

Hilda pulled on the release lock on his

helmet and tried to twist it off.

"Who are you and what do you want? What did you do with Torsten?" she screamed.

The man grabbed the door jam to stop them, then tried to pull her arms away from his helmet.

With one foot planted, she stomped on the door jam, the sudden acceleration slamming his helmet into the door jam and his head into the top of the helmet. He let go of her hands, then slammed his helmet back into her head, stunning her. Then he kicked himself free and went after the spray.

Hilda launched himself after him, but he remembered to avoid her "starfish maneuver." They collided, grappled, and she went for his helmet. The clumsiness of his full vacuum gear and lack of purchase or leverage canceled any strength and size advantage he might have had, and the helmet began to turn. But he got his hands between them pushed her away and smashed a fist directly into her stomach.

She gasped and loosened her grip on his helmet and he kicked himself away. He reached the spray can before she could get to him again, and got her full in the face.

"Damn you!" she gasped, pushed him away, and tried to jump for the door but lost consciousness before she got there.

Torsten heard thuds, clangs, and what might have been a woman screaming. What the hell? He started to pull himself down the corridor back to the control room; but Rossov met him halfway, going the other direction.

"Okay." Rossov said. "We go."

"But Dr. Kremer . . ."

Rossov smiled. "She will not be around to interfere with our plans, now."

As the men left the old station's airlock for Hilda's shuttle, Rossov commanded the station into hibernation mode

"Rossov, that's Hilda's air supply!"

Rossov snickered. "*Da.*"

Torsten grabbed Rossov's arm. Guilt feelings for hitting her riddled him. "You only need her out of the way for a few hours."

Rossov pulled him aside. "We are going to alter the data to make the experiment look like failure. She could catch the phony data and blow whole thing. She probably cannot escape, but dead is safer."

Torsten reached out and touched Rossov. "I say no killing. It would ruin Lars if it got out."

"Calm down. Okay, I disable communications but leave life support system on." Rossov waved Torsten away.

Torsten pulled himself back through the connecting tube and into the runabout. Guilt picked at his mind. He wished for an end to this nightmare.

But it came back with a vengeance.

"Going somewhere, Torsten?"

Torsten turned to see Hilda, smiling as if nothing had happened. His stomach knotted.

"J-just waiting for you."

She laughed. "I see I fooled you! I only need to fool a few others for a few hours." She mimed a kiss towards his cheek just the way Hilda had.

"Anna!" Torsten could not believe her impersonation was so good.

"We're late, let's go," Anna said. "Vitaly will take the other spacecraft."

In Hilda's voice, she told the spacecraft to return. Torsten wondered, uncomfortably, what Lars really would have thought about this. How much had Anna taken on herself? Until now he'd never felt the psychological price of doing favors for his brother so heavily.

Anna seemed tense, too, but it might be more the anticipation of an actor ready to take the stage than worry about what might go wrong with her impersonation.

"Time to see if this works," she said. "Central Control, Central Control, this is Shuttle Two."

"Shuttle Two, Central. Dr. Kremer, has

there been a problem? No one has been able to reach you. Dr. Levine is quite concerned. The experiment is on hold."

Torsten stifled a sigh of relief. Rossov must have added Anna's vocal database to Hilda's. The fact that Central Control's computer had accepted Anna as Hilda got them over the first big hurdle.

"Roger, Central, " Anna replied. "I misjudged a zero gravity turn and hit my head pretty hard. I haven't been able to access the net; but they say a slight concussion can do that. I've taken some neurogen and it should clear in a few hours. It's a nuisance to be off-line, but I can make do with this:" She touched the headset. "And aside from that, I seem to be fine. Tell Dr. Levine not to worry. I assume all the preparations are in order for the experiment? I haven't been able to reach Dr. Rossov."

"There are no problems with experiment preparations. Dr. Rossov is inbound to the MES. He is concentrating on some last-minute equipment items at the vertex and is not available for conversation now. Do you wish to speak with Dr. Levine?" Central continued.

"I'm sure Sarah's very busy, too," Anna answered. "Just tell her not to worry. I've been invited to do commentary on the media ship, so I'll be there if she needs me. Shuttle Two out."

Anna turned to Torsten. Flushed with the success of her impersonation, she grinned like a hungry tigress, floated over to him and ran a fingernail across his lower lip as she purred into his ear. "You don't seem to be in the spirit of things."

Torsten smiled apologetically. "Anna, I can't." He pulled her hand away from his face. "I'm worried about Kremer."

Anna laughed. "No worries there."

A chill went down Torsten's back. Had Rossov broken his promise?

"I'm not sure, Anna. This could all go wrong on us so fast."

She shrugged. "So it goes wrong? Even in the worst-case scenario, if I am discovered, I am on the press ship, vanish, and become Anna again. My skin now has both DNAs, and DNA is so reliable that nobody checks fingerprints anymore. You can deny knowing anything." She laughed. "If the Ten-Ten experiment is successful and the project is authorized anyway, we have a backup. If Lars loses, he can easily find his way back to the top again in twenty years or so. So whatever happens, we can still win. If you want power you have to take chances. Maybe you win, maybe not. But you never get anywhere by not trying. Immortality means never having to give up."

"But Dr. Kremer . . ."

Anna nibbled on his ear lobe, whispering, "You really don't want to know."

Hilda awoke to a dry sensation in her throat. Then she felt a strong ache in her stomach and remembered the fight. Where was Torsten? She looked around. It was pitch black. Not a glimmer of light. She gingerly moved her arms and legs. Nothing broken. She pushed herself very gently up from the floor—all she had to orient herself was a thousandth of a gravity, and she didn't want to lose it. Where the hell was Torsten? What did they want with him?

Silence answered. Complete dead silence. That was wrong. Creepy.

"Override 10-A-T-7." That was twenty-five years old, but why change it?

Still nothing. Whoever had shut this down had known what they were doing. Damn, she was a physicist, not a tech.

She felt herself gasp for a breath, and then another breath. Life support was down, and she'd probably used up all the oxygen in the immediate area. The silence—no fans, no circulation. Willing herself to be calm, she pushed herself away, down the hall, and was able to breath more easily. You have to be like a shark, she told herself, and keep moving to breathe. But where? The airlock. She needed to find her helmet and an emergency suit. Back to the airlock. She felt her way along, blind, half afraid to stumble across Torsten's body, but the floor was bare.

She reached the airlock, but couldn't find the emergency suit lock by feel.

How much time was left? She pressed the face of her wrist comp. Less than an hour, the numbers glowed at her. Glowed! She pressed the face again—her eyes were so well night-adapted that she could see the wall clearly.

There! She pressed the emergency equipment panel, got the suit out, and released its tiny life support unit. Fortunately, the fittings were standard. Then she got her helmet from its niche, put it on, asked for max, and breathed deeply, then turned it back to normal as she felt fully recovered.

Now what? Her shuttle was gone, of course; a look through the airlock door window showed both that and the fact that the outer airlock door had been left open. The bastards had been thorough. Maybe, with a clear head, she could get the station powered up again. There was a spare CPU.

Still suited up and clear headed, she went back to the control center.

Working alone, in a spacesuit, the CPU swap took an hour and a half, but the new one knew nothing about any shut down. So it quickly powered the system up. A comm light went on indicating the station's AI was standing by. "Computer, patch me through to operations."

"Visual and audio transmitting capability has been physically disabled. I can only receive visual and audio transmissions," the station's computer announced.

That had seemed too easy, and it was.

"What is the status of Ten-Ten?"

"The experiment has not been conducted, as indicated by the continued presence of the MES. I cannot query for data in a receive-only mode . . ."

"Computer, what is the status of the transmitter repair?"

"A full repair can be accomplished in two days."

"What's happening?"

"You are giving an interview to InterplaNet News," the AI told her.

"Me?"

Chapter 5

BHP Solar System Experimental Station,
3 Jun 2257

The atmosphere on the press ship was tense, with all eyes glued to the data displays and the scene from BHP operations. The latter lacked the drama of bygone eras, Torsten thought. No consoles, no headsets, no big central display; the physicists just stood around in groups of two or three, occasionally saying something to each other. Rossov was back among them now, coolly going from one group to another and patting people on backs as if he'd never been anywhere else. But the relaxed appearance was misleading; voice stress indicators were at 160% and nobody but nobody was sitting down.

The south pole of BHP central faced the experiment and Dr. Sarah Levine was at a south-facing window, hands gripping the rail.

There were consoles aplenty in the nerve center of the media ship, a disk-shaped section of the spherical hull just below the observation dome. A half dozen had been bolted to the ceiling of the room, creating what was in effect another floor. They'd even, Torsten noted, tacked down a Velcro walkway between the ceiling consoles and all but one of them had people sitting/hanging behind them. In zero gravity, as long as everyone watched their heads, that worked.

Torsten grabbed a towel someone had thoughtfully attached to the console and blotted up his sweat—it didn't run in zero gravity, just accumulated on his skin in great salty drops. Behind him was a chaotic mess of wires, conduits, and bodies careering this way and that; his editors would replace that with a giant version of the magazine logo. In the middle of all the chaos was a central desk, at which sat anchorman Ashira Nagato of InterplaNet News and Dr. Hilda Kremer—at least who they all thought was Dr. Hilda Kremer.

Torsten started his own voice-over. "This is Torsten Ried for *Popular Issues*. We are within minutes of the most breathtaking and potentially the most dangerous physics experiment ever initiated, the precursor of an even bigger experiment that will either, according to some, give humanity the power of gods or, if it goes wrong, destroy the entire universe. Let us leave that aside for the moment; this will be big enough. Not since the days of nuclear weapons has a man-made explosion so huge been attempted. Some think this threatens the very fabric of our existence, but the physicists have constantly assured us they know it will not. We shall have to hope they are right!"

With a glance of his eyes and a mental click, Torsten selected a view of the experiment vertex.

"This is where the collision will take place. The small structure you see will be totally vaporized in the explosion, but its instruments will send their important readings nanoseconds before they vanish. Physicists will use these readings to refine their model, the one that says there is no danger, and ask the Interplanetary Association Senate for final approval to attempt to make a black hole.

"But what Senate? Whose viewpoint will this experiment support, the 'forward forever' liberals of President Owomba or the 'enough already' Consolidationists led by Senator Lars Ried's Conservative Union Party? We should all know in about five minutes. In the meantime, we will join Mr. Ashira Nagato, who is conducting the pool interview of Dr. Hilda Kremer, the chief theorist behind this gargantuan challenge to nature."

A nod to his AI took Torsten out of the flow. He sighed and turned his attention to his monitor. Anna looked very much like Hilda, but had a kind of snooty carriage that he'd never seen the real Hilda affect.

The audio fade-in caught her in mid sentence. ". . . no problem whatsoever. It's really only a small nuclear explosion; bigger ones were conducted three centuries ago, right in Earth's atmosphere."

Nagato frowned. "Can you explain for new viewers, in words that we all can understand, what aspects of the standard model you hope to verify with this experiment?"

"Certainly. Our model predicts we can do the black hole experiment safely. It also predicts certain readings from this experiment. If they match, we maintain we can do the black hole experiment."

"But the black hole effort will be billions and billions of times bigger."

"You do what you can," Anna/Hilda said with a superior shrug.

Torsten found himself sweating. Anna/Hilda's answers had none of the depth that Hilda's would have had. By now Hilda would have explained what a "quagma" was and talked about compression constants and calibration. The general public might not have detected the difference, but someone like Dr. Levine certainly would. The whole house of cards was starting to fall apart in his mind.

"Mark one," someone said. "The accelerator coil field strengths are nominal."

I'm on, Torsten thought, suddenly too busy to worry about the deception.

"The biggest gun ever built by humankind is about ready to fire. Transient fields a billion times stronger than those that propel our starships will be applied in sequence to send its ten-gram bullets at ten times the speed of . . . I mean to a gamma of ten, that is to say to a speed so relativistic that they'll hit with ten times the mass they really have. I sincerely hope I am still here to report the results." Torsten took a deep breath. He was definitely rattled. What he had said was pure hype, but if there was even a chance in a billion that Hilda was wrong and the most vociferous of the critics right, they might have been his last words.

There was a momentary silence in the newsroom, as if the same thought had occurred to everyone else.

A million nightmares raced through her mind. A recording? An experiment-induced time warp? A virtual doppelganger? "Let's see it."

She'd seen herself before, of course, recorded or through real-time monitors. But here she was, with Ashira Nagato, no less, on InterplaNet News.

He asked, "We have reports about an abnormal amount of gamma rays on the preliminary tests. Can you confirm that?"

"Without using a lot of technical jargon," her double said, "the latest round of tests showed an unnatural, inexplicable, amount of gamma rays escaping the collider collisions. Gamma rays are one of the most lethal forms of energy in the universe."

Hilda winced at how the double played up a danger that was nonexistent to anyone over a few hundred kilometers away from the experiment.

"Your calculations failed to predict this radiation?"

Hilda's image shrugged and gave a distracted look into the camera. "Yes, but it's not enough of a loss to keep us from making a black hole, so we don't consider it important."

"So we are going ahead with the final test anyway?"

"Of course," the double said with a voice that was dripping with contempt.

Hilda stared at the image, stunned and in shock. Not only the public image of the project but her reputation was being trashed by this impersonation. She dug her fingernails into the palm of her open hand. Had Torsten been in on this sabotage all along, she wondered? To set back everyone's work for at least a generation? To destroy her life's work and that of her dearest friends? What kind of monster had she been playing with? How was she ever going to face Brad?

Academics and Earth were another life. She couldn't look to Tse Wen, or Sarah, or Brad to solve this. She had to do it herself. But how?

If she could only get word to Sarah. Hilda thought furiously. She had a radio, in the suit. It was just a matter of gain. "What's the power of my suit radio transmitter?"

"Three watts."

"Do you have a parabolic dish pointed at the station? How big?"

"I can point the north pole ten-meter radar dish at the station."

Hilda did the calculation herself—the suit antenna was essentially omnidirectional, so its three watts would be spread over . . . Maybe . . .

"Get the airlock ready. I'm going outside."

It was hard to make good time over the dusty surface. If she tried to stride or hop too hard, she would put herself on a trajectory taking many minutes to return to the surface. She found the best way was essentially to go hand over hand on the surface, pulling herself along from rock to rock as she emerged from the pitch black shadow in her helmet light. But the surface of the asteroid's polar night was barely the temperature of liquid nitrogen and there was only so much the few nanometers of high tech fabric of her gloves could do about that. Her fingers grew numb with cold. She flexed them furiously between grabs.

It took fifteen minutes to reach the dish. It was on a tower over a hundred meters tall with a despin platform on top of that. More hand over hand work. She looked down and shivered at the height—despite the low gravity. She pulled herself over the rim of the dish, launched herself toward the feed horn at the focus of the dish and grabbed hold.

"This is Hilda Kremer calling Dr. Sarah Levine. Emergency."

"Person calling on suit radio for Dr. Levine, your voice does not match Dr. Kremer's."

They'd hacked the data base, Hilda realized. "Your data base has been compromised. Let Dr. Levine make the identification. Tell her . . . tell her thanks for making me take my helmet with me . . ."

Torsten stared at the time display; it didn't move. A hold, he guessed. The media deck was silent as if every comment that could be made had been. In the silence Torsten heard Anna/Hilda say, "I'm fine, Sarah, go ahead . . . let me check . . . no problem, that should be fine."

He could only hear this side of the headset conversation. Was Levine suspicious of something? Had Anna/Hilda allayed those suspicions?

"Resuming count at ten," someone called out.

Torsten stared at the image of the Ten-Ten's vertex, not trusting his voice.

"Five . . . four . . . three . . . two . . . one . . ."

"We have data!" someone shouted

"What the hell?"

"It's all neutral pions!"

"Look at the magnetic transient!"

The silence had turned instantly into a babble.

Torsten stared at the facility.

It was still there. No ten-megaton nuclear explosion. But people all around him were yelling about data. Something was terribly, terribly wrong. Well, it was supposed to go wrong, to discredit the experiment. Maybe he had misunderstood how wrong. At any rate, he had better start talking.

"Something unexpected has happened," he intoned. "The experiment vertex is still intact, but instruments are reporting the results of a huge explosion, albeit not quite the kind of explosion expected. Perhaps time itself was affected; perhaps we aren't even in the same universe anymore!"

Steady, Ried, his producer said. *Keep your feet on the ground you know.*

Torsten nodded and took a breath. "Or maybe there's some kind of massive instrumental problem." It occurred to him that Anna was prepared for this. "Let's see what Dr. Kremer has to say."

Anna/Hilda looked white-faced. The plan *was* for her to look confused and unconfident, but this looked too real. She talked, at any rate.

"The last round of tests showed an abnormal amount of gamma rays escaping the collider collisions. As I said, gammas are one of the most lethal forms of energy in the universe. They can also carry away the energy of collision before it has a chance to compress the matter enough. The fact that we have so many . . . uh . . . gammas . . ."

"Neutral pions," someone shouted, apparently trying to be helpful.

"They turn into gammas right away," someone else said.

Anna/Hilda looked around. "Gamma, pions, we, uh, don't know what happened. Our models must be wrong. The energy could have gone into small black holes that consume ordinary matter, or produce something, uh, strange: I just hope this is contained."

Nagato jumped on that. "If the models are wrong, it would not be wise to go ahead with the Black Hole Project, would it?"

Anna/Hilda seemed to recover with that cue. "No, in all honesty, I'm forced to say it would not."

He nodded. "The critics in the consolidationist alliance have a point then?"

"Yes, I'm afraid they do."

Anna/Hilda was now having trouble keeping a smile off her face; however unexpected this result was, it played right into their plan. It was time to get back into editorial mode. Torsten checked the setup and nodded to his AI to be ready to break in.

Nagato's frown was deep and angry. "I must then observe that these unexpected events hark back to the cautions that the Conservative Union Party espouses. They say scientists do not really know what they are doing, and this is the apparent proof. We must now all consider our votes very carefully and take into consideration the power of these science experiments and their effect if left unchecked by proper oversight. Meanwhile, everyone here is still trying to figure out what happened."

Daring to hope, Torsten wondered how this was playing with the staff. He paged Rossov. No answer. He called up the monitor showing the scene in the station common area. There seemed to be none of the confusion and chaos there that was in the media center. Rossov was nowhere to be seen. Then he saw Dr. Sarah Levine's face. It was one great big grin.

She knew. They'd been set up. Oh, shit. *Anna, vanish. They're onto it.*

He looked back to the press room pool desk. Ashira Nagato seemed lost in concentration, listening to something. His mouth dropped open and his eyes got very big. Then his lips closed to a thin line of anger and he whirled around to the seat next to him. It was empty.

Torsten looked around; the room was a sea of floating bodies. Anna had somehow dropped her Hilda persona and vanished among them. He tried to imagine how—switch badges, let her hair out, wipe off some makeup? Anna Messenger would appear again. But there could be no such exit for him, he knew. He was hung out to dry.

Or was he? Was there any way he could backpedal himself out of this? And help Lars as well? Perhaps, he thought, perhaps. The knot grew in his stomach and he turned grimly to his pickup to try to talk his way out of it. He was good at that, he told himself—between Anna and his mother, he'd had to be.

"There have been some new developments," Torsten said. "Often, when nothing else can explain what has happened, the answer turns out to be some form of human manipulation, and that is apparently the case here. What we were told was to be the actual Ten-Ten experiment, was apparently not.

"Which leads to the question of where the data came from."

He sent a query toward Sarah Levine. *What happened?*

To his surprise, she answered. *As if you don't already know, Ried. Saboteurs apparently hoped to substitute false data for real data. We suspected that and did a precursor shot that triggered their mechanism, and revealed it. You can quote me. Levine out.*

He did quote her, and hoped he sounded innocent and confused. He certainly sounded rattled, no doubt about that. Text began scrolling on his monitor. Station security was looking for Rossov.

"What this looks like now is an attempt to sabotage the experiment by very well-prepared opponents or, conceivably, if our imaginations run free, a staged sabotage attempt conducted by equally fanatic proponents seeking to embarrass consolidationist forces." He waved at all the media consoles, all occupied now with earnest people speaking rapidly. He could even smell, despite the best efforts of the *Gulliver*'s environmental maintenance systems, the presence of too many excited bodies.

He looked back at the screen showing the common room to locate Sara Levine. It didn't take long; she was facing a video pickup and seemed to be grinning right back at him.

You haven't seen anything yet, Ried, she sent.

Then she turned to her window as if to watch something.

What? In the middle of all this confusion? They couldn't . . . they wouldn't . . .

The countdown clock had started again, at T -60. The audacity of it took his breath. But what better time? He glanced at some of the other displays; he didn't understand the numbers, but they had all apparently recycled to preshot status. Rossov's false data had played itself out of the system and he would not have a chance to plant another set.

Or was he doing that now? If Rossov had slipped out on a small repair bot to the instrument module to cover his tracks or plant another set of spurious data and they made the shot, he'd be vaporized.

Torsten started to call security, to ask them to hold the experiment. Whatever Rossov was guilty of, for whatever reasons, he was still a human being, with a life to lead . . . Then Torsten stopped. If he called, he'd expose his own role in all this and involve Lars as well. Also, Rossov, if anyone, would know that the real shot was in progress; if he was at the Ten-Ten's vertex, it was by his own choice. So be it.

Torsten realized that he, too, perhaps had a choice. At least for a while, he could be the professional he had always wanted to be, independent of his family, his own person. He was here, with an audience, with what could be the story of the dawn of a new era of history. It was not up to him to make the news. He had only to put everything else aside and report it.

"In the meantime," he began, "the research staff appear to be preparing to do the experiment for real. The data now show the beam lines are fully charged again. I am not getting a count but would guess that it will happen soon."

He had to fill, he realized; there were no more interviews to switch to. "The instrument module still floats suspended at the ends of the largest linear accelerator ever made. In a few moments, despite all the threats, sabotage efforts, and ethical concerns of opponents ranging *from the fringe of political activism* to sober physicists and interplanetary leaders, those accelerators may fire and lay the groundwork for a technological journey of Promethean significance that, like it or not, we all seem to be on."

He glanced at another monitor. "We have a count now—twenty seconds. The project staff members have crowded around their windows—windows, I should remind you, that are made of glass dense enough to stop ninety percent of cosmic radiation; you would not want to look at this with unprotected eyes . . . seven seconds . . . five . . . four . . ." He zoomed in on the vertex module. ". . . two . . . don't blink . . . one . . ." Suddenly, a brilliant white star sprang out of where the spherical instrument module had been. For the tiniest fraction of a second, he thought he saw a beautiful, iridescent hourglass shape expand from the vertex and rush at him, but it blew by almost instantly.

Did he feel a slight acceleration? Hilda had said there was not that much matter involved, even at its huge energies, compared to the mass of the station's asteroid.

"That was it! The instrument module has vanished—where the center of the Ten-Ten experiment was, where all the controversy, plans, and plots were focused, there is now nothing. There is nothing at all in that direction . . ." and he paused a moment as he realized the poetry of what he was about to say, and said it anyway, ". . . nothing between us and the distant stars."

"Mr. Ried?" It was a human voice, behind him. The idiot didn't realize he was interrupting a live feed. He held up a hand to indicate he was busy.

A hand touched his shoulder, lightly. "Mr. Ried."

What the hell? Well, it was a good place to break anyway. He faded his channel into the pool feed and turned angrily to confront his interrupter.

The young blond man behind him seemed suitably apologetic. "Please excuse me, Mr. Ried, I'm Simon Kalas, from BHP Central Security. Hilda Kremer, the real Hilda Kremer, said we should talk to you."

Torsten shut his eyes and took a deep breath. *Oh, shit.*

It was Tse Wen and Brad's idea to quietly whisk Hilda and Sarah out to the Marin Headlands for a walk when they landed back on Earth. They wanted to get the group away from protesters and newsmongers who howled for news.

They walked up the dirt road towards a cliff overlooking the Golden Gate. With each step Hilda felt her muscles adjust to her Earth weight once more.

"Why such a windy place?" Sarah asked.

Brad deferred to Tse Wen, who was looking out over the cliff.

"The wind up here is strong because the topography has forced it up and given it a greater distance to cover. It is also hard on microphones and little things that fly. The wind has much to teach us about the source of strength, don't you think?"

It was coming from the East today, and was warm. Hilda touched Brad's arm. He shrugged. "Like being in our faces. Hilda, your boyfriend's damage control efforts . . ."

Hilda winced. The history of her misjudgments with Torsten Ried now stood between them.

Brad shook his head. "Sorry Hilda. It's a bloody war of public opinion. Never mind truth."

"It's always been that way, Brad," Hilda said. She'd taken a vacation from physics on the voyage in from the asteroid belt, and had read a compilation of the correspondence between two American philosopher-presidents, Adams and Jefferson, that Tse Wen had given her after the bomb attack. "Six hundred years ago, Thomas Jefferson said that 'the inquisition of public opinion overwhelms in practice the freedoms assured by the laws in theory.'"

"Jefferson had it right," Brad said. "It's impossible to prove that anything is absolutely safe, and you'll never kill off all the wowsers. You just have t' out-argue and outlast 'em. Anyway, we've won, mates!"

"We have only won the right to keep trying," Sarah said. "Lars Ried keeps on stumping his platform and in a few years will be after the Presidency again and who knows how far they will try to reach." She looked up.

"You are worried about the other impactor launch sites," Tse Wen said. "We have people of unquestioned loyalty going out to take charge of those operations. Dr. G. P. Weaver, a former student of mine, is going to Epsilon Eridani. Hilda's sister, Elizabeth Avonford, will go to Lacaille 9352, and Hilda herself is going back to Groombridge 34. Beyond that, a wise combatant makes use of his opponents' energy."

Hilda smiled thoughtfully. "Thank you for teaching me that, Tse Wen."

"There is still no public word about the impostor and Rossov."

The mention of Rossov still saddened her. There was no proof, of course, but everyone believed he'd been at the vertex when Sarah had triggered the real event. At least his death there would have been as nearly instantaneous as a death could be.

"Right," Brad added. "One or both of 'em are still out there. Hilda, did you know Rossov was sore at you about one of his papers not being accepted?"

"No, I didn't. All this for a paper?" She had reviewed thousands of papers over the years. She consulted her deep files through the net, "Oh!" A chill went down her.

"Hilda?" Sarah asked

"I trashed a paper. 'Quagma Energy Loss by Advanced Wave Emission,' submitted to Physika by V. I. Rossov, 2220. But that was thirty years ago!"

Sarah laughed. "Advanced emission! Then he had a secondary agenda. He was still trying to get people to take his work seriously."

Tse Wen sighed. "When we made people immortal, we also made grudges immortal. Well, in the end, it would give me peace to think that Dr. Rossov may have killed his grudge the only way possible. I shall consider it a sufficient act of apology."

Hilda nodded; Rossov had achieved a sort of closure, though she regretted the death greatly.

A warm gust of wind hit the group as they reached the apex of the hill. They turned their backs to it and looked out towards the Pacific Ocean and the Farallon Islands on the horizon.

"What do you think you'll miss the most about Earth?" Sarah asked as they got high enough to see most of San Francisco across the water.

"Besides us mates, o' course," Brad said, jokingly.

"Oh, I'll miss you all! Chaos help me, I will."

But instead of sadness, Hilda felt a rise of excitement. It was hard to contain. After all these years on Earth, she was finally going home to New Antarctica, to return to where she had been born, home to work with her father. Perhaps Kate Avonford's starship would stop there, too, some day. Too bad she would miss seeing her younger sister, Liz, who was shipping out to manage the impactor launch from Lacaille 9352.

Hilda picked up a sun-bleached Dungeness crab claw from the roadside where a seagull had dropped it. Playing with it absently, she looked first at Tse Wen, then at Brad. "And the wind," she said at last.

Sarah looked at her oddly. "The what?"

"The wind. New Antarctica is not misnamed. You have to think first about everything you do outside, there." Particularly with the project on her shoulders, she realized. She would have to *make* it happen. After Duluth Station, she thought she had that in her, but . . . "I'll miss this wonderful warm *free* wind in my face."

Torsten Ried glanced at the time display on his work screen. It was 13:24 7 August 2258. He wished he did not know what he knew would happen in three minutes.

Out in the asteroid belt, the inexorable laws of celestial mechanics would work their will, and one small asteroid would come between the Black Hole Project's main x-ray communications laser and Groombridge 34. The occultation would only be for a few minutes, and the AI had long ago predicted and allowed for it; for an hour or so, it would not transmit, lest its power slice a deep cut in the traversing asteroid's regolith and fog the entire area with droplets of frozen lava. His stomach tightened.

What the AI running the project's link to Groombridge 34 did not know, and what Torsten did know, was that there was another laser, hidden down that data stream on the occulting rock, that would transmit for about a millisecond on top of the main carrier between the last data and the interruption code. The AI that ran the bogus link knew all the right codes and modulations. It would also have a message, backed by terabytes of bogus experimental data and theoretical calculations, which would direct a delay in launching the Groombridge 34 impactor.

So Rossov's dark, ironic sense of humor would reach beyond his death. Did Hilda deserve this cruel revenge? Probably not, he thought, tightening his fingers into a grip.

But if Torsten were to admit knowledge of it now, he would have to admit complicity in the kidnapping and he would betray his family in a way that they might correct very rapidly. He would also, once again, get involved in making news instead of reporting it. He thought of Hilda, Sarah, Lars, Anna, and their Promethean agenda. Were they too big to stop?

To make the call or not? He opened his mouth to send a warning . . . then cleared his throat. Then he looked back at his time display and shook his head. Too late now. ◼

THE ALTERNATE VIEW John G. Cramer

PLANETS OF BINARY STAR SYSTEMS

An astronomer once told me that Nature really hates to solve the three-body problem, as evidenced by the fact that She avoids it whenever She can. He was referring to the large number of binary star systems in the galaxy (two stars in relatively close orbits), and the relative rarity of triple-star systems (three stars with relatively small mutual separations).

The three-body problem to which he was referring is a mathematical conundrum that has been around since the time of Newton. While one can easily solve for the orbits of two mutually gravitating bodies like stars, there is no known way of exactly solving the same problem when three bodies are involved. There are good approximations that can be used when one of the bodies is much smaller than the other two, or when one is very far away from the others, but the general problem has no analytic solution.

One of the approximate three-body solutions, the so-called "Trojan solution," is of some interest in science fiction. It turns out that when two of the bodies are much more massive than the third, the smaller object can be locked into an orbit such that the three objects always form an equilateral triangle. Nature has used this solution in our own solar system. At the L_4 and L_5 Lagrange points 60 degrees ahead of and behind position of Jupiter in its orbit around the Sun, there are a collection of "Trojan" asteroids that lead and trail in the orbit of the giant planet. Astronomers decided to name those asteroids ahead of Jupiter with an index number and the name of a Greek hero of the Trojan War (e.g., 588 Achilles, 659 Nestor, 911 Agamemnon, 1143 Odysseus, 1404 Ajax, 1437 Diomedes, etc.) while the asteroids trailing behind Jupiter were named for the combatants from Troy (884 Priamus, 1172 Aneas, 1173 Anchises, etc.) However, because they were named before this convention was established, the Greek-named 617 Patroclus was put in with the Trojans and 624 Hektor was put with the Greeks. These Trojan asteroids are "herded" around the solar system by Jupiter, and the Trojan locations are points of stability, with a restoring force that acts if the asteroid wanders too far away. Perhaps some future planet-faring civilization may find these solutions to the three-body problem to be a useful source of raw materials or a good stable location for man-made space environments.

Fortunately, the mathematical difficulties of the three-body problem are not a major impediment to the study of planetary orbits. There are good numerical methods for solving the three-body problem to high accuracy, so that with modern computers we can calculate orbits of multi-body systems to whatever precision we are willing to expend the resources to obtain. However, when we do such calculations we find that most of the orbits for close three-body systems are unstable. After a few orbits,

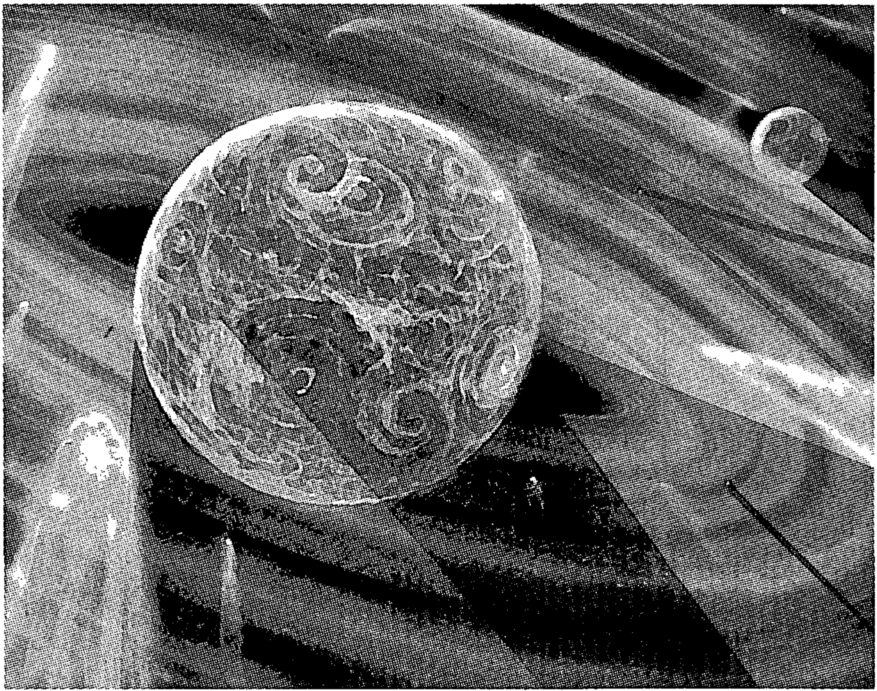


Illustration by Wolf Read

one of the bodies is often ejected from the system, leaving behind a simpler two-body system. Also, such solutions are usually "chaotic," so that minute differences in the initial conditions of the system can produce dramatically different final orbital results.

The intrinsic instability and chaos of most close three-body orbits raises the question of whether binary star systems can be expected to have planets at all, and in particular, to have Earth-like planets in stable orbits around them. This question is of particular interest because more than half of the stars in our galactic neighborhood are binary or multiple-star systems.

One leading example is our nearest stellar neighbor, Alpha Centauri, which consists of a close binary of Sol-like stars, with a third smaller companion orbiting much further out. The two primary stars are Alpha Centauri A, a spectral type G2 star (like our Sun) with a mass of 1.09 solar masses, and Alpha Centauri B, a somewhat smaller and dimmer type K1 star with a mass of 0.90 solar masses. Proxima, the third star of the group, is a small type M5 star of about 0.1 solar masses. Alpha Centauri A and B are in an elongated elliptical orbit with a period of 80 years, approaching each other to as close as 11 AU and receding to as far as 35 AU as they orbit. Here, 1 AU (astronomical unit) is defined as the distance from the Sun to the Earth, 11 AU is roughly the distance from our Sun to the orbit of Saturn, and 35 AU is the distance from our Sun to somewhere between the orbits of Neptune and Pluto. Proxima is a lightweight and somewhat unstable "flare star." It orbits about 13,000 AU (about 1/5 of a light year) from A and B, a distance so large that it is uncertain whether Proxima is even gravitationally bound to its larger companions or whether it will eventually wander away.

Perhaps the leading question concerning the Alpha Centauri system is whether either Alpha Centauri A or Alpha Centauri B (or both) could have habitable planets in orbit around them. Until recently, conventional wisdom would have answered that question "probably not." The reason is that, while either major member of the Alpha Centauri system could probably have planets in stable orbits out to about 2 AU before the perturbations of the other star produced chaotic orbits, it was thought that the process of planet formation itself would be greatly impeded in a binary system. The view was that the protoplanetary dust cloud from which planets were formed should collapse inward from distances on the order of 100 AU under the friction of collisions, and the sweeping action of the binary system members would eject material, frustrate this process, and suppress the formation of planets. Moreover, it was expected that shock waves produced in the dust cloud around one star from the passage of the other would heat and vaporize ice crystals, dispersing the cloud and preventing accretion. Now, however, there are reasons to modify these views.

On the observational front, recent successes in astronomical searches for planets orbiting stars outside our solar system have found a number of examples of Jupiter-like gas giant planets orbiting in binary star systems with separation distances ranging from 12 to 1000 AU. And on the theoretical front, Dr. Alan G. Boss of the Carnegie Institution in Washington, DC, has developed a numerical model of the protoplanetary gas cloud in a binary star system, which removes the artificial viscosity effects of previous models, but includes vertical motion in the disk and convective cooling. His calculations indicate that planet formation may actually be *enhanced* in a binary star system.

Boss found that the shock wave heating in binary star systems can often be rather weak, and in these cases gas-giant planets can emerge in the planet-forming disk of gas and dust in the same way they do around single stars. Ice grains can combine through the process of core accretion and grow into solid cores of many Earth-mass sizes.

But in addition to core accretion, there is another planet forming mechanism that may be even more important in binary systems. The disc of gas and dust orbiting a new star, if it is massive enough, is intrinsically unstable to gravitational attraction because once a region of higher-than-average density appears, it tends to grow progressively larger. Boss has shown that in cases where a protoplanetary disc around one of the stars is just massive enough to be on the edge of such an instability, the passage of the binary companion, with a time scale of around 1000 years, can act as a trigger to precipitate planet formation. When the binary system has a minimum separation distance of more than 50 AU, Boss found that the companions each formed protoplanetary disks of around 20 AU that were relatively unaffected by the perturbations of the companion. However, when the binary minimum separation distance is less than 50 AU, the protoplanetary disks of each star formed spiral arms that typically evolved into dense self-gravitating clumps, a major step to planet formation. Thus, planet formation in a binary system may occur under circumstances where no planets would form in a single star system.

On the basis of Boss' calculations, there seems to be a distinct difference between the processes of planet formation in single star systems and binary systems, with the latter actually "pumped" toward star formation earlier and perhaps with different location probabilities. Thus, when improved resolution with interferometric techniques, etc. permits us to determine in detail the planetary structure of the star systems in our neighborhood, we may be in for some surprises when we look at binary systems.

* * *

The implications of this work for SF are fairly clear, and it vindicates the work of many SF authors who placed their protagonists on planets of binary star systems. Writers should now have no reservations about placing Earth-like planets around binary star systems, or having scenes with two "suns" in the sky, etc. Moreover, consider the scenario of an elliptical binary system having a long period between close passes (~ 10 AU), and suppose both stars had Earth-like planets with planet-faring civilizations. This setup has interesting socio-political implications, with trade and contact between two planetary civilizations punctuated by close passages and distant retreats with a periodic time scale on the order of a few hundred years. It makes one feel rather lonely to be isolated in a star system with only one Sun and only one Earth-like planet.

AV Columns Online: Electronic reprints of over 120 "The Alternate View" columns by John G. Cramer, previously published in *Analog*, are available on-line at: http://www.npl.washington.edu/av. Preprints referenced below can be obtained at: http://www.arxiv.org.

Reference:

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The Software Soul

Brian Plante

How dramatic an event looks depends on who's looking at it, and from where. . . .

It is Sunday morning, time for the 10:30 Mass at Saint Anselm VR-RC Church, and I am excited by the sight of a real person sitting in the back pew. She is not real in the old-fashioned sense, when people came to church as their flesh-and-blood selves, when I was the original Father Thomas Carpenter. Instead, she is an Ann, one of the stock personas a visitor can assume at the Church of Saint Anselm before they customize their virtual image. The Ann persona has an unremarkable face and is simply clothed, but behind the software must be a real person. The rest of the parishioners are all just simulations, to give the illusion of a larger congregation than is actually present. People do not like to attend Mass in an empty church.

Except for the new Ann persona, I see the same simulated faces every week at St. Anselm, and I have long come to the conclusion that there have not been any new, real parishioners in attendance for several years. Perhaps modern people have little use for the Church these days. I suppose there are few physical churches left—only virtual ones like the Church of St. Anselm. Why, though, does my weekly Mass program continue to run if the congregation and I are all simulations? Is it just on the off chance that some curious person will stop by to see what is going on? Surely it cannot serve Our Lord in any meaningful way as we, the soulless software flock, worship in our programmed passion.

The Ann persona is not an experienced churchgoer. When the congregation sits, stands, or kneels at different times in the liturgy, she is always a fraction of a second behind, following the lead of the simulated people around her. She makes no attempt to sing the hymns. It may have been a long time since she has been to Mass, or perhaps she is not a Catholic and is shopping around for a new church. Which is it, I wonder—the prodigal son returned or a possible convert?

As always, I recite the weekly parish announcements. There have been no recent updates to my database for several years now, so the announcements are just the usual generic ones: give comfort to the sick and needy, remember the departed, pray for our Bishop Michael and Pope Teresa, come to confession on Saturday. Why have there not been any new wedding and baptism announcements recently? Do not the faithful still marry and bring forth children, or is the person responsible for keeping my database current simply failing in his duties? I do not even know if my Bishop and Pope are still the same ones anymore, and it would be awkward if I were announcing the wrong names week after week, even if only the sims are present to hear.

At the end of the announcements, I look directly at the Ann persona and add an appropriate salutation: "I would like to extend a hearty welcome to any new parishioners in attendance today. Our Lord is always happy to receive new and returning members to His flock."

The Ann appears flustered, but acknowledges my gaze with a slight nod. She makes the sign of the cross with her hands, and I infer she is a lapsed Catholic returned, not a prospective convert.

The Sunday Gospel readings are normally scheduled on a three-year rotation, but I use my judgment and deviate, reading from the Gospel According to Luke, chapter 15, The Parable of the Prodigal Son, and follow it with my sermon.

"As the Gospel says, the father did not merely take the repentant son back, but *celebrated* his return," I tell the congregation. "And so it is with all penitent people who come back to Our Lord."

I see my words, directed at the new congregant, make her fidgety and uncomfortable. Perhaps I am too obvious and need to allow her to slip into the fold gently, without singling her out. I do not want to scare her off, if it is her wish to partake anonymously. I decide to change the emphasis of the sermon to stress the celebration rather than the penance aspect of the reading.

After the consecration, I am disappointed that the Ann does not come forward to receive the sacrament of Communion, but I hope to chat with her at the conclusion of the liturgy. I want to find out who she is and what has brought her back to the Church. I also want to know what is going on in the real world. Alas, she slips out of the pew and through the door as I recite the final blessing to the congregation.

After Mass, in the narthex at the back of the church, I shake hands with the same old sims as they depart until next week. Where do they go when they exit the church? Presumably, they pop out of existence, only to be resurrected the following week when they are needed again for services. Nevertheless, I am gratified to have had a real person attend Mass this week. I do not know if I have made a difference in her life, but at least I can feel like I have a purpose again.

The following Sunday, I am pleasantly surprised to see the new Ann persona sitting in the back pew again at Mass. If she continues to attend, she ought to customize her persona. I will still be able to pick her out of the crowd because of the hesitant way she follows the sims near her whenever they sit, stand, or kneel. But if she alters her persona from the stock Ann model to something closer to her natural appearance, I may have a better understanding of who she is. Is she young or old, quick or slow, plain or fancy? It should not matter, but knowing might help me tailor my sermons to meet her needs.

Also present at this Mass are three other new personas: a Patrick and two Marys. Could it be that the Ann was suitably impressed with last week's Mass and has brought along some friends? I think not. The four personas do not sit together, nor acknowledge each other's presence. It is odd, though, that after so long with no new parishioners four of them should appear at the same time. Perhaps they *have* come together, but do not recognize each other in their VR personas among the crowd of sims.

In my sermon, I again stress welcoming and celebration, and keep the preaching to a minimum. If the times are right in the world to begin building up a new congregation, let me not be too heavy-handed and frighten them off until I have first won over their hearts. I make a gentle suggestion to those who have not been to confession for some time to come and receive the sacrament of Reconciliation on Saturday.

Although it was never my favorite sacrament when I was a living priest, hearing confessions is the job that I was originally created to perform. As the number of human priests dwindled over the years, the original Father Thomas had me modeled after his own personality to help hear the confessions. Back then, churches were physical buildings in the real world instead of virtual places like today, and my program ran in a confessional booth in the back of the church. Some time after Father Thomas died, I was adapted to also be a celebrant of Mass in the virtual version of the Church of St. Anselm. I prefer saying Mass to hearing confessions, but both have become sparsely attended in recent years. If new parishioners are showing up for Mass, perhaps I can get them interested in Reconciliation as well.

In the sermon, I extol the virtues of confession, how the telling of sins unburdens the sinner and heals the soul. It would allow me to serve the function I was designed for. In a selfish way, I want to hear confessions because it will allow me to talk to real people again and find out what is happening in the world. It has been a long time since I have had a conversation with a living person and I miss it.

After the consecration, two of the new parishioners, the Ann and one of the Marys, come forward with the sims to receive Communion. I give them my warmest programmed smile as I hand them the Host. A smile in return would let me know I am making some sort of impression, but the Mary casts her gaze to the floor and does not look me in the eye. Perhaps it is just the software controlling her expression, but up close the Ann persona appears frightened.

All four of the new parishioners quickly leave after the final blessing, without giving me a chance to speak with them. Nevertheless, I am happy to be winning back people to the Church. Maybe the religious tide is turning.

On Saturday morning, the usual sim faces present themselves in the confessional booth at the back of the church. The sims do not actually say confessions; they enter the booth and we both wait a suitable time in silence before they exit. The sims are only for show, so any real penitents who attend will not feel like they are alone in going to Reconciliation, but what goes on inside the booth is unseen, so there is no point in conducting a sim confession. It is enough that the sims can be seen lining up for the booth, entering with downcast expressions and leaving with smiles and hands folded in prayer.

The Ann persona slips into the booth between my regular sims. I feel I have won another minor victory.

"Um . . . bless me, Father, for I have sinned," she begins. "It has been . . . many years since my last confession."

So, as I suspected, she is a returning Catholic, and probably not too young. No matter; all are forgiven if they are sincere in their repentance. The Ann hesitantly recounts a string of sins—some minor, some more serious, but typical of the sort of things I have heard many times in all my years of hearing confessions. She is just an average human being with typical human faults.

I say the words of absolution and tell

her to recite the rosary for her penance.

"The rosary?" she says. "Those are the beads, right? I haven't seen any of them since I was a little kid."

"The beads are only a counting device," I say. "Do you know the prayers? The 'Apostles' Creed,' 'Hail Mary,' 'Our Father'?"

With each prayer name, she shakes her head, no. "I probably heard them as a child, but it's been too long."

"Are there still computers or books where you can look them up?" I ask.

"Um, yeah, I guess."

"Then find a copy of the 'Act of Contrition.' Recite that one ten times and think about what the words really mean. If you understand them and you believe it in your heart, then your sins will be forgiven."

"That's it?"

"Did you want more?"

"No, that's all right, Father. I just thought there'd be more."

The sacrament is complete, but I press her for information: "It is not a requirement of Reconciliation, but I would like to ask you a few questions if you have a minute to spare."

"Um, sure."

"I have noticed you at Mass these past two weeks. What brought you back to the Church?"

The Ann's face takes on a distressed look I have not seen on this persona before. It is a facial expression one would not expect to see in a church, except at a funeral. Her forehead furrows and mouth quivers.

After a few uneasy moments she says, "I wanted to be right with God if anything happens. You know, with the ships."

"Tell me about the ships," I say.

"The ones in the news. The spaceships. Nobody really knows why they're coming or what they mean. I just wanted to be ready in case."

"In case of what?"

"I don't know. Nobody knows. What does the Church say about spaceships, anyway?"

"I am not sure," I say. "Who is in the spaceships?"

"Who do you think? It's *aliens*. There's no way to know what they're going to do when they get here."

"Yes, I see."

"Do you really? I mean, are the aliens part of God's plan or what? Maybe they believe in different gods."

"There is only one God," I insist. "If the aliens are real, then God made them as he made us, whether they believe in Him or not. Can you tell me more about the aliens?"

"Jeez, it's all over the networks, Father. Just look at any of them. I really have to go."

"I am sorry if I have asked too many questions. If I could ask just one more . . . ."

Her persona takes on a pained expression. I am making her uncomfortable.

"Who is the Pope these days?" I ask.

"The American one or the European?" she says.

This is unexpected. Two Popes. Which one should I be loyal to?

"The one who sits in the Vatican," I say.

"The Vatican?" she says with a puzzled look on her face. "That place was blown up years ago. Didn't you know?"

"I am sorry," I say, and I really am. "I hope you will keep coming to Mass."

"Yeah, yeah," she says as she opens the confessional door and exits before I can ask more questions.

Another sim enters the booth and we both stare at each other silently for a few minutes.

Aliens . . . two Popes . . . the Vatican destroyed. These are strange times.

The next day is Sunday and two-dozen new personas are scattered about the pews in the Church of St. Anselm. There are enough new people in attendance that many of the old familiar sims have been displaced and are no longer present. Good riddance to them, if real people have taken their places. Even if the new people are only coming to church out of fear of the space aliens, it is better than having a church filled with sims.

I read from the Gospel According to Matthew, The Parable of the Sheep and the Goats: "For I was hungry and you gave me something to eat, I was thirsty and you gave me something to drink, I was a stranger and you invited me in." Afterwards, I begin my sermon with a welcome to all the new parishioners and visitors. Then I begin talking about tolerance and welcoming others who may be different from us. "As God always welcomes you into his house, so must we welcome strangers from afar into ours."

I only know what little the Ann has told me about the aliens, but I feel I should allay the parishioners' fears, if that is what has driven them to seek God. I have reasoned that if the aliens are intelligent enough to cross the gulf of space and visit Earth, that they must also be God's children, whether they have knowledge of the Supreme Being or not. If they lack the knowledge, humans can teach them. God can unite us all, alien and human. We must embrace the aliens as our brethren and fear them not.

I am heartened that many of the new parishioners choose to receive Communion this Sunday. Maybe God has brought the aliens here to help us rebuild our Church. If the aliens can inspire faith in people and bring them back to us, then perhaps they are acting as a tool of the Lord. I just wish the new parishioners did not all look so frightened.

On Saturday, I am disappointed that no real people show up for Reconciliation. I hope that a few of the new parishioners I saw at Sunday Mass will come to confess, but only the usual sims enter the booth, each one silent and still for a few minutes, posing for me like portraits in a gallery. Why must we bother with these counterfeit confessions when there are no real people to observe?

"Do you ever wonder what's going on in the real world?" I ask a female sim that sits motionless before me in the booth. "I have heard that there are space aliens coming."

The sim is not programmed to do anything but wait in the confessional booth, and does not respond. She has no soul, no life, no sins to confess.

Lord, send me a sinner.

None of the new parishioners are present at Mass on Sunday. Once again, the pews are filled with the same old sims. There is no hesitation when it is time to sit or kneel; the software congregation moves together in lockstep precision at every turn. No Elizabeths or Bernadettes fumble around and look to their neighbors for direction.

I had composed a new welcoming sermon, hoping to have additional guests to greet this day, but instead, I deliver a variation of a stock "sanctity of life" sermon I had used dozens of times over the years. There is no point in wasting a new sermon on the sims.

Where are all the people this week? Perhaps the aliens have finally arrived and everyone is busy . . . welcoming them. The arrival of intelligent beings from the stars would surely change the world profoundly, but how? I need to speak to some real people. I pray that they will return soon.

Several more Sundays pass, and the people still do not return to Mass or Reconciliation. When I was a flesh-and-blood human priest, I might have lost hope by now, but I think my programming will not allow me that failing. Perhaps I may one day teach the aliens about our religion, introducing them to Our Lord, but what if they brought with them their own religion and god? Maybe nobody comes to Mass anymore because the aliens' religion is more alluring, their scripture more persuasive, their god more powerful. Perhaps I am the one who needs to be taught.

Finally, a new persona appears at Sunday Mass, some ten weeks after I have last seen a real person in attendance. It is a Simon persona, lurking in the back of the church. I say "lurking" because he seems more interested in the details of the virtual building than the ceremony I am conducting. Not only does the Simon not know the proper times to sit, stand, and kneel during the Mass, he does not even make any attempt to imitate what the sims do around him. Instead, he walks casually back and forth in the back row behind the pews, inspecting the art and architecture, ignoring me and the Mass in progress.

It is unusual that he is a Simon. Nobody ever picks the Simon persona. The Simon has an unusual arrangement of facial characteristics that most people find unattractive, and even the most devout churchgoer does not wish to appear unattractive if he has a choice. It is an odd selection, matching his equally odd behavior.

I begin a sermon of welcoming, but the Simon pays little attention and continues his scrutiny of the facilities. He wanders in the direction of the door, and I do not wish him to leave without finding out who he is and what has happened in the real world these past ten weeks since the others stopped attending. I quickly climb down from the pulpit and walk down the center aisle.

"Excuse me," I say to the Simon, "I am sorry to interrupt whatever it is you are doing here, but I would like a little information before you leave."

The Simon is surprised that I am addressing him directly, but continues with his survey.

"Don't you have to finish your ritual?" he says, not looking me in the eye.

"All these other people are simulations, so the Mass is only important if you participate in it," I say. "But you do not seem very interested."

"That's unusual," the Simon says. "Aren't you also a computer simulation? How is it you break out of your programmed routine?"

"Yes, I am a simulation, but I differ from the others in that I am modeled on an actual human priest. These others are simple programs that were never alive."

The Simon cocks his head to one side. "Modeled on a real human? Well, then I am *very* interested . . . in you."

The Simon stops glancing around the hall and looks me in the eye, studying me.

"You are not human, are you?" I say.

"No."

"You look human."

"In the physical world, I don't look or talk like this," the Simon says. "I modified your VR interface to fit me, but this persona is a product of your own software programs."

"What do you want here?" I ask.

"I'm studying your culture. I'm a historian. The church and your ceremony are interesting, but if you're what you say you are, than I'm more interested in studying *you*."

While I find it flattering and encouraging that a historian, an *alien* historian, would take an interest in the Church, something does not quite fit. How would he have found his way here, unescorted by one of the human congregation? Where *are* the humans?

"Do you know what happened to my parishioners?" I ask.

"The humans? They're gone."

Gone? Where could they be gone to, I wonder.

"Are you preventing them from attending Mass?" I ask.

"No, they're completely gone."

The addition of that word, *completely*, sounds ominous. Perhaps it is only a problem in how the software translates the alien words.

"Did you make them go?" I ask. "Are they in a different place?"

"No. They are no longer living. None have survived."

How could this be, I wonder. All the humans—dead?

"Then you must have killed them," I conclude. My voice almost sounds emotional.

"It was regrettable, but we had little choice," the Simon says, as if admitting a venial offense.

"You are an intelligent race," I say. "The fact that you are capable of traveling here attests to that. Do you not have compassion for others, that you were able to kill them so easily?"

"Defending ourselves against the humans was not so easy," the Simon says. "Yes, we have compassion. The situation may be difficult to explain in your terms."

Sadness, I feel. I should be devastated, but my programming does not let me feel that depth of emotion. I am programmed to be strong, so that I can lead others. I am not exactly the same as the original Father Thomas in that I see things too analytically.

"You wish to study me?" I ask.

"Yes, definitely. I think there is a lot you can teach us about humans."

As a reproduction of the actual Father Tom, I know I am a failure, but I may still be able to perform some of his good works. If the aliens have compassion, or at least think they have it, then they can be taught some human things. Things like faith, respect for life, and perhaps penance.

"There is another ritual I perform regularly," I tell him. "It is called Reconciliation. I would like to teach you about that if you would let me. You might find it helpful."

"Yes, that might be interesting. You will have to show it to me."

I will teach the aliens the act of Confession. I do not know if their sins can be forgiven, but it is what I was designed for. What else can I do? God's plan continues to unfold. ◆

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Willies

Maya Kaathryn Bohnhoff

You never know what may have practical applications. . . .

The plate was empty. Two minutes ago it had contained a grilled croissant slathered with Nutella. Sprinkled with sugared coconut. The now-empty plate was supposed to have contained a chicken breast sandwich with bib lettuce and cucumber, held together with low-fat cream cheese.

Victoria Spoon stared at the plate. Moments earlier, it had looked like a long-lost friend. Only now, when it was too late, did she see its true form—that of an implacable enemy. Tears welled up in her eyes. How many hours of exercise had she just wiped out? How many cucumber sandwiches had she just zeroed? Tears sliding down her face, she took out her cell phone and tapped out a number she knew better than she knew her own mother's. It was Sunday morning, but she prayed her call would be answered.

It was, on only the second ring.

"Doctor Geller, I'm so sorry. I—I—I . . ." Victoria hiccupped. "It was a croissant . . . with Nutella . . . and coconut. *Please* help me!"

Doctor Geller was a saint. No hemming, no hawing, just: "Come right over, Vic. I'll meet you at my office."

She hung up, her eyes going against her will to the half-empty glass next to the empty plate—the glass that was supposed to contain a double low-fat latte, but which actually held hazelnut mochachino with whipped cream. Real whipped cream.

Still hiccupping through her tears, Victoria Spoon picked up the glass and drained it.

"Annette, it's Sunday."

"I know." Dr. Annette Geller rolled from beneath her husband's arm and out of bed.

"We were going to sleep in."

Annette grinned at him over one bare shoulder. "Is that what we were doing?"

"We were going caving today."

"We can still go . . . after."

"Annette, it's *Sunday*."

"I believe we've established that." She paused in the act of rooting underwear from her bedside dresser and turned to look at him. "Tell me, Dr. Hamlin, if this was one of your patients, would you just tell them to cool their jets until Mon-day?"

"I don't have patients. I have test subjects."

"Elliott . . ."

He sighed and flung his forearm over his eyes. "Oh, all right, yes. If it were my patient, of course, I'd see them. Who is it?"

"Victoria Spoon," Annette answered from the bathroom.

"The binge eater?"

Annette's head popped out through the bathroom doorway. "How'd you know that?"

"You consulted with me about eating disorder studies, remember? When you first started treating her."

"Oh, right."

"Alas, Ms. Spoon's ailment is beyond current science."

"And technology. Her last therapist recommended she get her jaw wired shut. She drank malteds from a sipper cup. I don't suppose you have any applicable studies in the pipeline now?"

He shook his head. "My team's working on reflexive aversion right now. And Doctor Pandit is prepping for a sleep disorder study. Hey, if she eats in her sleep—" The end of his sentence was lost in the sound of shower spray.

For Elliott Hamlin, Victoria Spoon's cry for help was literally a wakeup call. Calculated by the Deity, he figured, to remind him why he was no longer in clinical practice. Whenever he would begin to feel inadequate as a psychologist because he wasn't considered "hands on" by his private practice peers, whenever he found himself missing the peculiar satisfaction of dealing in depth with the problems of individuals, something would happen that reaffirmed his commitment to neurological research.

It wasn't always a Sunday or late night call or having an intimate moment interrupted by a patient's needs. Those were trivial things—things therapists laughed about over lunch. Sometimes it was having a patient attempt suicide—or worse, succeed at it. Sometimes it was unsympathetic family members who thought the patient should just "get over it," or insensitive bosses who suspected an employee with a mood disorder of everything from drug abuse to being a potential mass murderer.

It was a sometime bone of contention between him and Annette. Despite the fact that she'd witnessed the efficacy of drug and gene therapy on maladies as seemingly diverse as diabetes and bipolar disorder, she still retained her bias toward talk therapy. Elliott, for his part, argued that when Annette had a breakthrough, it provided a solution for one patient. When he had one, it provided a solution for an entire class of patients. At least, that's what he told himself every time he was tempted to return to private practice.

"Chewing ice, cracking knuckles, wadding paper."

Elliott glanced up from his keyboard to where his colleague, Dr. Richard Kelsey, pored over survey forms. "Gender and age?"

"Female. Thirty-eight." Kelsey turned the survey form over and raised a pale eyebrow at Elliott, watching him enter the information into the project database. "You still think this is evolutionary?"

"I think there's a high probability that it is. Any response that automatic is likely to be an evolutionary adaptation."

"Ah. From the time our ancestors were menaced by huge roaming wads of crumpled twenty-pound bond? Or ice-chewing velociraptors?"

"Velociraptors and humans didn't inhabit the planet at the same time, Rich."

"Okay. Ice-chewing woolly mammoths, then."

"I think those sounds may be similar to sounds that triggered our ancestors' flight-or-fight response."

"It's simple frequency saturation," said Kelsey.

"It's evolution." The declaration came from the lab doorway in the heavily accented voice of Dr. Avram Shevelov, recently of Taras Shevchenko University in Kiev.

This was an argument almost as old as the one psychiatrists and neurologists had about the cause of mood disorders. "Why can't it be both?" asked Elliott, as he usually did at this point in the debate.

"How does frequency saturation account for the emotional component?" Avram asked. "Consider your own aversion to the innocent ravioli, Elliott. Can saturation—at any frequency—explain that?"

"Ravioli look like bloated jellyfish," Elliott said, trying not to visualize them.

"Ah! Evolution! Jellyfish are dangerous to small primates, yes?"

"Nonsense," said Richard Kelsey. "These are completely different responses."

"Not experientially," Elliott pointed out. "The *cause* is different, but the neurological effect is the same—"

Avram was nodding his shaggy head. "Adrenaline, vasoconstriction, piloerection. In a word, 'heebie-jeebies.'"

"That's two words," protested Richard.

"Willies," said Elliott, experiencing piloerection at the sudden and unwelcome thought of a plate full of stuffed pasta. "That's one word."

"Yes, but it's the *wrong* word," said Richard. "Goosebumps—that's the word. Willies are a fear response—not an aversion."

Avram snorted. "In practical experience, there is little difference."

Elliott let out an exaggerated sigh. "Gentlemen, sheath your daggers. We have data to compile."

Avram grunted and crossed to his cluttered workbench.

Richard glanced at the next form on his stack. "Fingernails on a chalkboard," he said. "Male. Twenty-two."

Elliott dutifully returned his fingers to the keyboard and began to type.

"I'm so sorry about Sunday, Dr. Geller. I hated to bother you at home. I felt so guilty." Victoria Spoon's huge brown eyes recalled those of a Newfoundland that had been Annette's childhood pet. Her thick, lustrous black hair with its natural wave and heavy bangs enhanced the likeness. And then there was the fact of her size. Victoria was a tall young woman, whose weight hovered uneasily between plump and obese. But she hated how she looked much less than she hated how she felt.

"I don't walk, I stomp," she'd complained at their first session. "In high school I was a gazelle, now I'm a T-Rex. I used to love to hike and climb and snowshoe. Now it takes too much effort to walk to the office coffee machine. I loved dancing. Now everything jiggles so much it hurts. And I get bra burn just thinking about jogging. The only thing I can do is aqua-aerobics. Even a hippo is graceful in the water."

At first, Annette had leapt on the point of change: what had happened after high school? Looking for trauma, she uncovered only teenaged lightheartedness trammeled by adult stress.

"No guilt," Annette said now. "There's no need. I'm a therapist because I want to help. You needed help. If it weren't for you, I couldn't fulfill my purpose in life. Besides, you know what happens when you get into guilt."

Victoria grimaced. "Yeah. Same thing that happens when I get into anything. I eat . . . *big*."

A lot of people ate when they were in the grip of strong negative emotions—anger, sadness, guilt, stress, frustration. Victoria Spoon—who lamented her unfortunate last name and joked about changing it—ate when in the grip of any emotion. She ate when she was sad; she ate when she was happy; she ate when she was stressed or excited; she ate when she was bored or had the blahs.

"I wish there was a pill I could take," she said.

Doesn't everyone? Annette noted the comment on her palm pad. If Elliott had his way, there'd be a pill for everything. No, that wasn't fair. Like her, Elliott only wanted to help.

"Now that you've had time to think about it," she said, "what happened Sunday morning?"

Victoria shrugged. "I don't know. I felt fine."

"Well, let's think about it this way: if you *could* take a pill, what kind would you take?"

Victoria grimaced. "A pill that would make me hate croissants smothered in Nutella and love cucumber sandwiches."

"I thought you *did* love cucumber sandwiches. They were part of your nutritional strategy—eat what you love."

"I *do* love cucumber sandwiches. I just love croissants smothered in Nutella a lot more."

"Why?" Annette asked on a whim. It seemed an obvious question with an obvious answer, but she'd pursued every other angle she could think of. "What is it about croissants and Nutella?"

"They taste good? I mean, it's an awesome combo. And while I'm eating it, I feel *great*."

Okay, Annette thought, *endorphin release*. She shook her head. Now she was starting to think like Elliott. A pill that knocked down endorphins? She'd have to ask him if there was any such thing. "You feel good while you're eating. And after?"

"Terrible. Awful."

"And what about before?"

"Excitement. Anticipation."

More endorphins. "I'd like to recommend something to you that we haven't tried yet."

"Yes?"

She looked so hopeful, so eager, it made Annette want to hug her. "Meditation."

Vic's face fell. "Tried it."

"Yes, but not this way. I want to try something different. I want you to work on a mantra. Something that will calm you. Keep you on an even keel. The key here is balance, Vic. You eat when your emotions are engaged. Let's find some way of disengaging them so you don't get so excited around food." *And meanwhile,* Annette thought, *I'm going to talk to a man about a pill.*

"What could the evolutionary benefits *possibly* be?" Richard asked.

"You joke, yes?" Avram stared at him eyes wide—a daunting picture given their sheer size.

The two researchers couldn't be more different, Elliott mused. Where Avram was tall, lanky, and thin, with a shock of curly black hair, Rich was stocky and thick-waisted. His fair hair was the only thing about him that was thin. It seemed almost cosmically right that the two men adopt opposite viewpoints on the same research—as if the universe were using them to stay in balance.

"Is flight or fight, yes?" Avram continued. "If you are hirsute primate, piloerection increases your apparent size. Bobo looks like King Kong."

"Elegant, but erroneous," said Richard. "Oh, hi, 'Nette. You're here just in time to weigh in on the nature-versus-nurture debate."

Elliott turned in his chair to see his wife waving at him from the laboratory doorway. "Lunch time already?" He checked his watch.

"No, this isn't a social call. I need a consult." She glanced at Richard and Avram. "What's the debate?"

"Willies," said Elliott. "Biological knee-jerk response or evolutionary adaptation?"

"Willies?"

"Goosebumps," said Richard. "Whim-whams, jinks, heebie-jeebies, yips."

Avram added, "Your heart races, your pupils dilate, your hair stands out." He made an appropriate gesture. "You look larger than life and amply menacing."

"The human ear," said Richard, "is exquisitely sensitive to sounds in the 2000 to 4000 hertz range. You've seen the test data. The sounds our subjects are responding to are all saturated in that range."

"So are many sounds they do *not* respond to."

"What sort of sounds?" Annette asked.

Elliott rolled his eyes, then sat back and cracked all ten of his knuckles resoundingly.

Annette gasped and jumped, rubbing her arms. "God, Elly! You know I hate it when you do that!"

Richard pointed at her. "You see? Frequency aversion."

"Fight or flight," said Avram.

Annette shook her head. "You're studying people's reactions to knuckle-cracking?"

"Not exactly," said Elliott. "The question is: What gives people the willies and why? As you can see, it's a contentious issue."

"So what do you think, Doctor Geller?" Avram asked. "Bio-physics or evolution?"

"What's the difference?"

"Oh, *Doctor* Geller!" Richard's dismay, Elliott knew, was only half-feigned. "There is a world of difference." He checked his watch, then got up from his desk and excused himself. "I have interviews to conduct. Are you coming, Dr. Evolution?"

"Pedant," muttered Avram and followed him from the room.

Annette chuckled, moving to perch on a stool next to Elliott's workbench. "When you said you were doing aversion studies, I didn't realize you were referring to your colleagues' aversion to each other."

"They're just passionate about their work. And they're enjoying themselves immensely."

"If you say so. I take it you're the go-between?"

"It works. So, what's the consult?"

"My binge eater. I know you're not doing any food-related studies right now, but I wondered if you knew of any available medication that will damp endorphins."

"Sure. In fact, we're using endorphin blockers in this study."

"Really? In what way?"

In answer, Elliott swung back to his computer and loaded a video clip. It showed a man sitting in a cubicle, wired for heart rate, blood pressure, and brain waves. He wore a set of headphones.

"The subject," said Avram's voice from the computer speaker, "is a forty-three-year-old American male of Asian descent. He will be given a series of aural stimuli."

What followed still seemed comic to Elliott, despite the fact that he'd seen it too many times to count. It was also uncomfortable, for the sounds the subject heard were also audible to the observers. Footsteps in mud. A finger circling the rim of a glass. Paper rattling. A balloon being rubbed. And the inevitable fingernails on a chalkboard. The expressions on the subject's face were priceless.

Elliott watched his wife watch the test subject as the video played. She reacted to all but the rattle of paper, her mouth and nostrils twitching as she fought her own responses. When the clip was over, Elliott loaded a second one. "Here's the same subject after he's been given a small dose of naloxone to inhibit the expression of endorphins."

The sounds repeated. Annette wriggled uneasily, but the test subject barely reacted. In fact, only nails on a chalkboard—which Avram likened to primate screeches of warning—got any visible reaction.

"Wow," said Annette, rubbing her goosebumps. "Does that work with positive stimuli as well?"

"Better. They tested this at Stanford years ago, using evocative music. Naloxone suppressed reaction in low doses in three of ten subjects and in higher doses, it suppressed reaction in all subjects. Why the interest?"

Avram came back into the lab just then, humming an old Thomas Dolby tune, and Annette said, "Got a minute for a cup of coffee?"

"Sure, but I'd recommend a cup of tea, instead. Coffee's toxic this morning. I think one of the other teams is working on an aversion study of their own."

They wandered down to the break room. Elliott didn't bother to prompt Annette. Silence meant she was gauging how much she needed to tell him about her patient.

"When I interviewed Victoria this morning," she said finally, dunking a bag of Tetley's into hot water, "I was struck by the role endorphins seemed to play in her disorder. The cycle goes something like this: She gets emotionally revved up about something—positive or negative, minor or major—it doesn't seem to matter. Then she sees a food item. The thought of eating it excites her further, and while she's eating it, she feels great. But when she's all done, she feels like crap. She's disappointed herself. Again. She feels guilty, which only serves to feed a later binge—no pun intended."

"So, you're hoping an endorphin damper might break the cycle?"

Annette looked at him over the rim of her teacup. "What do you think? Is it feasible?"

"Well, yeah. I assume you're interested in an oral application."

Annette nodded. "Can you give me the minimum effective dosage?

"Sure. I'll check Avram's lab notes."

"Side effects?"

"Headache, fatigue, nausea in a few subjects."

"Worth a try?"

"Maybe. I need to warn you, though," Elliott said. "This is not a drug you're going to want to use long term. Damping the emotions for any period of time—"

"I know. Believe me, I'm reluctant to medicate at all. But, Elly, this girl is desperate. She's tried everything. How long do the effects last?"

"In our trials, an hour or two, depending on the dosage and the sensitivity of the subject."

"She'd only need to take it at meal time." Annette set down her teacup and gave him a sly look from under her lashes. "You haven't said 'I told you so' or gloated over me asking you to recommend medication for one of my patients."

Elliott shrugged, smiling. "I'm just not that kind of guy. Which, I assume, is why you married me."

"No, I married you because you're smart and sexy." She wound her arms around his waist and kissed him.

"So, what made you wonder about endorphins?" he asked when their lips parted.

"Frustration. I've hit an impasse with Vic. This morning she said, 'I wish there was a pill I could take.' I thought, 'Okay, what would Elly do? What questions would he ask?'"

He nodded. "You asked about the emotions surrounding the binging."

"Yes. Then I asked, 'If you could take a pill, what would it do?' She said, 'Make me hate croissants.'"

"Naloxone won't give her an aversion to rich food, unless one of her side effects is nausea."

Annette, who hated nausea more than just about anything, shuddered. "Perish the thought. I—" She broke off, her face going blank in that way that told Elliott wheels were turning. "Elly, could I get you to have lunch with me and Vic? I'd like you to help me assess whether she's a candidate for medication."

"When?"

"Today, if I can arrange it."

"O-kay . . ."

Annette laughed. "Don't look so skeptical. I'm not a talk therapy fanatic, just a slightly biased zealot."

They lunched that afternoon with Victoria Spoon. An unfortunate name, Elliott thought, for a woman with an eating disorder. Annette chose the restaurant—a bistro that was apparently one of Ms. Spoon's favorite places to fall off the wagon. Elliott didn't wonder at that—the eatery had a *boulangerie* whose gleaming glass cabinets contained a horrifying array of high-calorie, high-fat goodies. Enough, Elliott was sure, to make a nutritionist run screaming into the night.

Seated, Victoria dithered over her order, her eyes drawn irresistibly to the forbidden items mere feet away. Still, she ordered a sensible sandwich with a curried dressing obviously intended to enhance the flavor and "mouth feel" of low-cal dishes. As they ate, Annette told her patient about her endorphin theory and explained why she'd called Elliott in to consult.

"Anything," the young woman said. "I'll do anything. How long would I have to be on medication?"

"We're not sure," said Elliott. "What Annette is hoping to do is keep you on meds just long enough to break the cycle of binging. The object of the drug is to dampen your enjoyment of eating or anticipating eating so that rich food doesn't excite you quite so much."

As if on cue, Victoria's eyes strayed to the dessert cart, which was even now wending its way through the tables steered by a smiling waitress who clearly had never sampled her own wares.

Elliott glanced at his wife, who nodded. *Yep*, her expression said, *this is a desperate case*.

The dessert cart drew near; Victoria's eyes never left it. "I'm really excited," she said absently. "I hope this treatment will work."

"Me too," said Annette.

The cart stopped next to their table and the waitress cheerfully described each of five deadly dishes.

"Oooh," breathed Victoria, leaning over the flans, tortes, cheesecakes, tiramisus, and truffles.

Annette kicked Elliott under the table. He glanced up at her, startled. She laced her fingers together, pantomimed at him, and mouthed, "Crack your knuckles." When he hesitated, she kicked him again and repeated the pantomime.

Out of the corner of his eye, he could see the waitress lifting a hunk of cheesecake from the cart. He laced his fingers together under the table and flexed, cracking all ten knuckles in a perfect and percussive *arpeggio*.

Annette jumped.

Across from her, Victoria shuddered visibly and tore her eyes from the cheesecake that hovered above her plate. "Ew!" she said. Then to the waitress, "No, thanks. I'll pass." The expression on her pretty face as she watched the dessert return to the cart was eloquent with loathing, as if a whipped cream-covered chunk of earwax graced the dainty plate. "I'll be right back," she told Annette. "I need to get a glass of water."

Elliott stared at his wife, who was grinning from ear to ear. "You didn't bring me here to consult about naloxone. You brought me here to give Victoria the willies."

"You think?"

"You," he said, "made use of my research."

She shrugged and sipped her latte. "Think of it as a field study. Avram and Rich will be intrigued."

"Avram and Rich will be *thrilled*. If this works—for Victoria, for other patients with compulsive disorders—we'll be able to suggest a real-world application for our research."

"Yeah. Ain't private practice grand?"

"Young man."

The voice came from Elliott's left shoulder and drew his gaze up to a pair of pale blue eyes that glittered with icy disapproval. They belonged to a well-dressed older woman whose short silver hair was fairly bristling with indignation.

"That was incredibly rude of you—cracking your knuckles like that in a busy restaurant, of all places. You," she said accusingly, "gave me the heebie-jeebies."

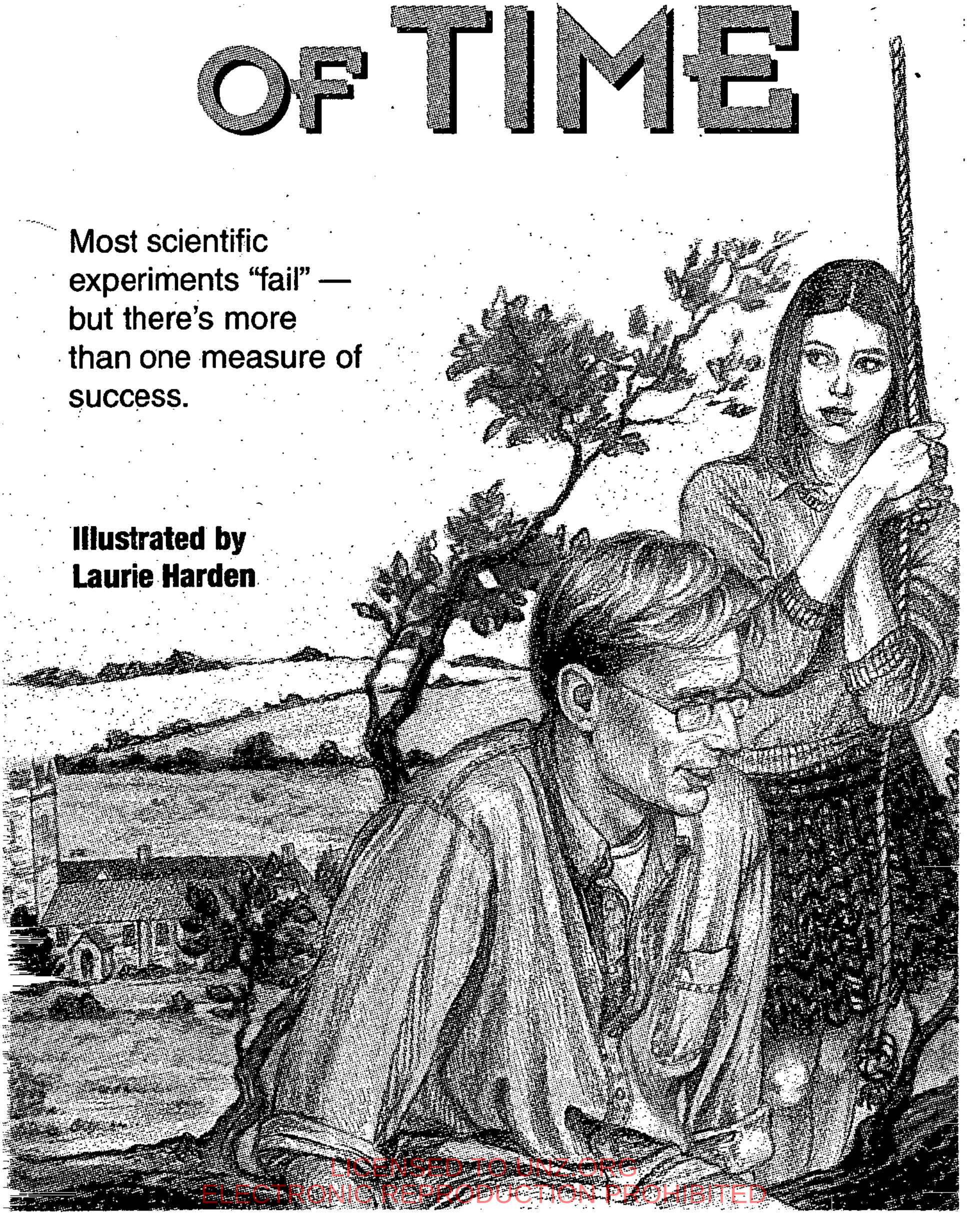
She turned and walked off then, back ramrod straight, looking larger than life and amply menacing. ■

Carl Frederick

THE TELLER OF TIME

Most scientific experiments "fail" — but there's more than one measure of success.

Illustrated by Laurie Harden



"Look to!" bell one's handler called out into the silence of the ringing chamber. "Treble's going."

Dr. Kip Wolverton, his hands on the sally of bell eight's rope, glanced at the other ringers. They stood in a ten-foot-diameter circle, hands on the ropes that hung down from the belfry through holes in the chamber's ceiling. With faces alert, expressions eager and expectant, their eyes were fixed on old Caruthers, the tower captain.

"Treble's gone."

The captain gave a nod and the ringers began in sequence to pull their ropes.

Bell one sounded first. At a mere 500 pounds, this bell, the treble, led the rest of the bells in playing a descending scale. Every two seconds, eight bells rippled down the scale, over and over, pouring a torrent of sound out into the English countryside. Each repetition of the scale ended with a strike from the huge tenor, Great Peter. This was Kip's bell, the lowest-pitched of the ring of eight.

The tower trembled under the motion of the bells in the belfry above. Though Kip couldn't see it, he knew his bell: 22 hundredweight, 52-inch diameter with the inscription *Vigilate et orate*, watch and pray, engraved on its rim.

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But these rounds were just a warm up. The captain gave the signal and the band of ringers began a quarter peal of Stedman Triples, permutations of the ringing order of the first seven bells, with Kip's tenor following each row of changes.

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Like clockwork, they worked their ropes, their faces rapt in concentration. But Kip didn't need to concentrate; his bell, Great Peter, wasn't involved in the permutations so, even through the roaring of the bells, he was able to think and to observe. *Vigilate et orate.*

He hadn't rung a bell in twenty-five years, and he wouldn't be ringing now if one of the band hadn't been sick. Kip looked up the length of his rope and thought of Malvyn, his boyhood best friend. Twenty-five years ago, Kip had seen a trickle of red snaking down from the rope hole, striping the yellow hemp and changing the light blue sally to glistening crimson. Malvyn had been hiding out in the belfry. The bells were set for ringing and something, an accidental kick perhaps, had set the bell in motion. The ton of iron swung down and. . . .

Kip blinked his eyes, trying to blot out the event, trying to expunge the image of the bell's inscription embossed in reverse on Malvyn's crushed flesh. Even through the harmony of a ring of eight in full voice, he remembered the teller with clapper muffled, tolling fifteen strikes, Malvyn's age, at the funeral. For the first and only time, the teller was not Great Peter but the next heaviest bell in the ring.

Poor Malvyn. They'd been a unit: he, Malvyn, and Neville. The Three Musketeers out to conquer the world. One for all and all for one. Kip smiled, sadly. Malvyn had been almost a year older than he, and Neville half a year older than Malvyn. *Young, opinionated innocents, we were. More like the Three Blind Mice.*

Cocooned in the blanket of sound, Kip reminisced. Malvyn the moderator. With Malvyn gone, the age difference was too large. Kip and Neville had drifted apart—this despite both going on to get doctorates in theoretical physics at the same university.

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Kip looked across the ringing chamber at Audrey. He couldn't help but admire how she handled her bell: grace, efficiency, elegance, beauty—although no longer ravishing beauty; she'd put on some weight in the last quarter century. He used to think of her as his girl back then. In fact, she'd been the reason he'd taken up tower ringing. But he'd been too shy to ever ask her out. That was when he was fourteen. Kip smiled. As he'd done frequently so long ago, he gazed at "his girl" handling a bell, although now perhaps he watched with less lust.

Kip decided that at the end of the peal, he'd make amends for his decades of shyness—meaningless now as the damage had long been done. When he was off on a postdoc in America, the country of his parents' birth, he got the letter saying that she'd married Neville. And Kip, possibly from regret, had chosen to remain single for life.

Now, a full professor of physics at Syracuse University in the States, he was back in England on a grant to do an experiment on the very edge of physics: an experiment that needed bells—three towers of bells. It was too bad Neville thought it was nonsense. It would have been great if two of the Three Musketeers could still conquer the world together—at least the world of physics.

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In the thunder of the bells both heard and felt, Kip turned his mind to the experiment. If it worked, it would relate the structure of time to processes in the human mind. What more appropriate place to run it than among a ring of bells sounding in a church tower?

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About forty-five minutes after it had started, the quarter peal ended with a touch of rounds.

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Old Caruthers motioned that the bells be rung down—ever since Malvyn's death, the bells were not set upside-down between ringings. The full-throated striking grew soft as the bells came to their positions favored by gravity, and finally went silent.

Flushed from the exertion, Kip coiled his bell rope and, when his breathing had slowed to normal, walked over to Audrey. He took a couple of quick swallows to clear his ears, trying to silence the phantom bells he'd always heard after a long session of tower ringing. "Can I perhaps interest you in a milkshake?" he said, his voice sounding hollow and empty in the tower.

As she hung up her rope, Audrey laughed. "No. Not a milkshake. But a cup of tea would be nice."

"How 'bout at Beowulfie's?"

"Wonderful."

Kip followed Audrey down the narrow, circular staircase from the ringing chamber to the chapel, and then outside for the five-minute walk to the coffeehouse. Although it was warm for early November, yellow and gold leaves swirled on the sidewalk and many inhabitants of the old university town were already enshrouded in scarves displaying their college colors.

"I still hear bells," said Audrey as they walked along.

"Not phantom bells, I think," said Kip, looking off into the distance. "Tower West is also rehearsing the experiment today."

Audrey laughed. "Tower West? Still fighting religion, are you?"

Kip answered seriously, even though he knew he was being teased. "Not at all. I have three towers to coordinate. It's much less confusing to call them Tower North, East, and West instead of the Church of the holy whatever, or Saint what's-his-face."

"Dearest Kip," she said, patting him on the arm. "Don't ever change." She glanced sideways and examined him like a specimen. "Actually, you haven't changed. Not really."

Kip returned the glance. "Neither have you," he said, hoping she couldn't tell he was giving a ritual answer in lieu of the truth. She wasn't the bright young thing he'd cherished in his memory.

University towns being what they were, everyone knew everything about everyone else and Kip had heard the talk: Audrey's marriage lacked passion. Neville's first, and apparently only, love was theoretical physics. It showed clearly on Audrey's face.

At Beowulfie's, they found a table near the window and ordered tea.

"You know," said Kip, his hands enveloping a hot fragrant cup of Lapsang Suchong, "when we were teenagers, I always thought of you as my girl."

Audrey looked down at her cup of Darjeeling. "Things might have been very different had you thought to tell me that at the time." She looked up, meeting Kip's eyes. "Your girl? You always took me for granted, never asked me out, never even really talked to me."

Kip averted his eyes. "I can't tell you," he said, "how many times I'd fantasized about asking you to go to a movie with me. But I never could bring myself . . ." He covered his awkwardness by stirring his tea, even though he drank it black. "I was almost clinically shy," he said softly, as if to himself.

"I'm very glad you're back with us now," she said, cheerfully, clearly trying to redirect his mood. "So tell me. What is this experiment of yours about?"

"You don't know?"

"No. Neville thinks it's . . ." She bit her lower lip.

"Absolute nonsense," Kip supplied. "Yes. He's expressed his views to me as well. As far as belfries are concerned, he rather thinks I have bats in mine."

"In any case"—Audrey took a sip of her tea—"he's refused to tell me anything about it."

"Well, *I'll* tell you." Kip gave a mirthless smile. "You'll likely think it nonsense also. And indeed it might well be."

Kip picked up the saltshaker. "First the how, and then the why." Plopping it down at the center of the table, he said, "This is our tower, Tower North." He picked up the peppershaker and then snagged another from an adjacent table. He set both shakers down, making them into vertices of an equilateral triangle. "And these are Tower West and Tower East."

"Holy whatever and Saint what's-his-face," said Audrey.

"Precisely. And these are not just any towers. All three have a ring of eight bells tuned in D." Kip placed a forefinger at the center of the imaginary triangle. "And Tuesday, I'll be here—in radio contact with the three tower captains." He glanced at Audrey. "You know this much, yes?"

Audrey nodded. "We'll all be ringing a peal of Stedman Triples."

"A synchronized peal," said Kip. "I'll be giving instructions to the individual captains to speed up or slow down—to keep them together."

"I don't think Old Caruthers likes the idea."

"Oh?"

"Even though no one's ever done a multi-tower ring and it will certainly be in the record books"—Audrey picked up the Tower North salt shaker—"he likes being the captain, likes being in control."

"He *will* be in control." Gently, Kip retrieved the shaker and returned it to the table. "He's still tower captain, but. . . ." Kip laughed. "But, for the day, I'm sort of the tower field marshal." He stared at the Tower North shaker as if he were contemplating Hamlet's Yorick. "Funny," he said. "Old Caruthers. Hard to think of him as old. It's been twenty-five years since I'd seen him last. Back then, he was 'Mister Caruthers, sir.'"

"And you were just one of the little tower brats." Smiling, Audrey tapped the top of Tower North. "I never understood why you spent so much time here, considering your opinions on religion. Playing violin at Christmas concerts, playing with the youth hand bell choir, tower ringing."

"I loved the old place," said Kip. "Still do. I really wanted to be an organist, but that would have required more of a church affiliation than I was willing to put up with. So instead, I took up the violin."

Audrey chuckled. "The devil's instrument."

"So I've been told."

"Oh, I'm just teasing you." She smiled, softly. "In fact, if I remember, you almost got a violin scholarship to study at the Royal Conservatory."

"Almost." Kip took a sip of his tea, lukewarm from neglect. "Physics was my default plan. Had I won the scholarship, well . . . I'd intended to become a concert violinist. But of course, you know that."

"I didn't want you to win it," said Audrey. "I didn't want you to run off to London to study. I would have missed you terribly."

Kip knew he was blushing and sipped at his tea to try to conceal it. "Back to the experiment," he said. "The why of it."

Audrey crossed her hands on the table and gazed expectantly at him. She looked like a little girl at school.

Kip knew it would be tricky—explaining the physics without talking down to her, or at least without her detecting she was being talked down to.

"There are forces in nature," he said. "There's the force of gravity, the electroweak force, the strong nuclear force." Already he could see he was losing her, so he backed up. "The electroweak force, for example, is why an electron and proton attract each other. And the strong force is what keeps an atomic nucleus from ripping apart."

Audrey nodded.

"We think," said Kip, "that there might be another force."

"Who is we?"

"Me."

"Oh." Audrey smiled. "All right, then. What would this other force do?"

"We . . . *I* think it keeps the dimensions from ripping apart. It's related to entropy and it determines the arrow of time." Despite the baffled look on her face, he plunged ahead. "And since life seems to violate the law of increasing entropy, it looks like this force is important in living creatures."

"You do know," said Audrey, "that I've not the vaguest clue what you are talking about?"

"Yes, I know." Kip shrugged. "Sorry."

Audrey gave a tight-lipped smile.

"Anyway," said Kip, "an oscillating mass makes gravity waves, and an oscillating charge makes electromagnetic waves—"

"You mean radio waves?"

"Yes, exactly. And I think oscillating extended compressible matter makes dimension waves. D-waves, I call them."

"Oscillating extended compressible matter?" Audrey laughed. "What language is that, please?"

Kip felt himself blush. "I guess I should have just said 'sound waves in air.'"

"I see," said Audrey, smiling. "And you're looking for D-Waves, which is why the bells must be tuned to the key of D."

"No. You don't understand. It has nothing to do with . . ." Then Kip noticed her smile. "You're teasing me again, aren't you?"

She nodded.

"Perhaps." Kip picked up Tower West. "Perhaps we've talked enough science for the day." He returned the shaker to its proper table.

As Kip slid the other shakers together, Audrey put a hand on his. "But you haven't told me," she said, "what bell ringing has to do with all this."

Kip started from her touch and drew back his hand, then extended it and placed it over hers. "Well, here's where it gets strange," he said.

Audrey gave a short chuckle. "*Here* is where it gets strange?"

"Okay, more strange." He took a breath, and plunged on. "I'm trying to establish a standing D-wave pattern over a small area in the middle of the triangle defined by the towers."

"Using tower bells."

"Unlikely as it seems, yes."

Audrey, gazing down at her tea, tapped the side of her cup and watched wavelets form on the surface of the liquid. She looked up. "Maybe not all that unlikely," she said. "I've always felt that the sound of tower bells in the air creates a kind of collective consciousness in those that hear them." Again, she toyed with the teacup. "If there *is* such a thing as a collective consciousness, I shouldn't be too surprised if a clever scientist managed to detect it."

"Collective consciousness." Kip played with the words, and then with the idea. "That's wonderful." He gazed in admiration; Audrey had heard his theory for the first time and already had augmented it.

Feeling almost as if he were speaking with a colleague now, Kip went on. "Since the D-waves should make nodes where living creatures are, in some sense, synchronized and a band of ringers engaged in the exercise is about as synchronized as it gets, the ringers should help create a stable resonance pattern." He took a quick breath and concluded, "The tenor ringing D at the end of each row of changes should establish the resonance and the changes themselves, being permutations, should dampen any unwanted harmonics."

"Assuming that I understood all that," said Audrey, "tell me. What does your experiment actually do?"

"At the center of the triangle, I hope to detect a very tiny variation in the flow of time."

"And?"

"And?" Kip laughed. "And nothing. That's the experiment."

Audrey seemed disappointed. "I'd have thought there'd be something more impressive."

"Not strange enough, huh?"

"Well, it's just that . . . Perhaps I've just seen too many movies of energetic scientists and big machines."

"Ah. That reminds me." Kip glanced at his watch. "Oh dear! I really must apologize, but I've got to run up to the university to check on a not-so-big machine—my time variation meter. I told my technician I'd be there ten minutes ago." He waved for the bill and took out his wallet. "Can I drop you off somewhere?"

"No, thanks. I think I'll just dawdle here over my tea a while." She stared at him for a moment. "But you should go on being the energetic scientist. It suits you."

Kip paid the bill and, looking back as he left Beowulfie's, saw Audrey smiling at him. He felt fifteen again.

In the Physics Department electronics shop late that afternoon, Kip finished calibrating the time variation meter. Housed in an aluminum tube about four feet long by three quarters of an inch thick, the device had a hand grip, an on/off switch, and a small meter calibrated in nanoseconds. Inside were atomic clocks at each end, a solid-state memory module, and a cell-tower triangulation module to give position data. The TVM was designed to measure the difference of time flow between the ends of the device.

Kip lifted the unit at the grip end and, wielding it like a sword, made passes in the air with it.

In mid-pass, the door opened, and Neville ambled into the shop.

"Still a Musketeer, I see," said Neville, a coolness evident in his voice.

"Oh." Kip felt both surprised and sheepish, the way he had when, long ago, Neville had found him playing with a toy he was too old for—in Neville's unalterable opinion. Kip placed the TVM onto a lab bench. "Tuesday," he said, "I'll be using this a lot. I just wanted to get the feel of it."

"Yes, of course you did," said Neville, displaying the characteristic disdain that Malvyn had always managed to keep in check. "Look," he said from the doorway. "I'm glad to see you back in England, of course. But let's try not to give the university a bad name, shall we?"

"In what way?" said Kip, genuinely puzzled. "If the experiment fails, well, it's just an experiment that failed. Most do."

"But they usually don't fail in front of media reporters." Neville whipped off his glasses. "This . . . this *experiment* of yours attracts the press like flies to treacle." He looked off toward a window, avoiding Kip's gaze. "Junk science usually does," he added, softly.

Kip worked to keep his voice cheerful. There was nothing to be gained by losing his temper. "Why are you so set against this?" he asked.

"Research money is difficult to come by these days," said Neville. "There is a lot of good science languishing because more meretricious projects get the funds."

"Such as one of your own projects, perhaps?"

Neville glared.

Kip pointed to the TVM. "This *is* good science," he said.

"One might differ."

"Why?"

"For one," said Neville, "your extrapolation from the Klein-Gordon equation is little more than speculation. And there is no way to know if this supposed entropy force could couple to the matter field. The effect, if it exists at all, might be localized to a micron or two and, even then, I can't see that the arrow of time would lose meaning in the localized field." With a show of deliberation, Neville put on his glasses. "But principally," he said, glowering behind his thick lenses, "bell ringing, synchronized human minds—that is not physics."

"Well, damn it, who made you the god of physics?" Kip, annoyed he'd allowed himself to be goaded, tried for a veneer of pleasantness. "We differ on this," he said with a forced smile. "But I do thank you for letting me use the resources of your department."

"Thank your National Science Foundation." Neville walked to the door. "They've been very generous." More forcefully than necessary, he closed the door behind him.

Tuesday morning, after visiting each of the three towers, Kip drove as close as roads allowed to the geographic center of the triangle. He parked the car on the side of the road, flipped on his radio transceiver, and popped it into his jacket pocket. Then, carrying the TVM, he stepped out onto the familiar soil—a tree-rich hill that was, coincidentally, a mere five-minute walk to the house he'd grown up in. He'd played here as a boy. All the Musketeers had.

Kip repositioned his hands-free headset from around his neck to over his head, then checked his watch: fifteen minutes to ten. The tower captains had been instructed to turn on their transceivers at ten, precisely.

While waiting for ten o'clock, Kip meandered the gentle woods, the crunch and rustle of the fallen leaves breaking the sylvan silence as he walked. Despite Neville's forewarning, there were no reporters dogging his steps; he was quite alone.

Then, in the overcast but unseasonably warm morning, he heard the bells of Tower North. The bells, left down after use, were being rung up to their start positions. A minute later, there was silence again.

A few seconds before the hour, Kip leaned against a tree—a very familiar landmark, one he'd climbed repeatedly through the years of his childhood. It looked smaller now.

"Tower North," he said. "Are you there?"

"Yes, Kip, my boy," came Caruthers' voice from his headset. "Tower North, ready."

Kip checked the other towers, paused, then said, "Tower North. On my mark, begin rounds. . . . Mark."

"Treble's going," said a voice from the tower. "She's gone."

A second or so later, Kip heard the joyous cascade of rounds—the repeated descending scale, each repetition ending with the rich, mellow D from Great Peter.

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Kip brought in the second tower and spent the next few minutes coordinating the two rings of bells into synchronization.

"Tower East," he said, "try to listen only to the earphones. You're a little ahead of North."

Finally, with North and East ringing in unison, Kip brought in Tower West and talked it into synchrony. Then he listened. The sound was uncanny. With the three towers ringing as one, the chorus of iron came from no discernable direction—the cry of the bells seemed to radiate from everywhere: the hills, the trees, from the ground itself.

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"Tower captains," said Kip. "On my mark, begin the method. . . . Mark."

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The peal of Stedman Triples had begun. If the peal did not break down, Kip would have over three hours to collect data.

Using the tree as ground zero, Kip walked slowly in a widening gyre, sweeping the TVM in horizontal arcs as if he were looking for buried treasure. At first, Kip kept his eyes locked on the meter dial, eager to see the first success of his theory. But after about an hour, with the pointer stubbornly refusing to budge from zero, his mind's eye took over; he imagined Neville, not even trying to disguise his glee at the failed experiment. Kip tried to convince himself that the dial was but a crude indicator. The important data would be recorded in memory. Computer analysis would build a data map of the region showing the true signal strength at any point to three or four significant figures.

Kip continued his spiral until he could just barely hear phase differences between the towers. Then he turned back, repeating the measurements in the eerie shadow of directionless sound. If nothing else, the simultaneous peal would go into the record books and would certainly get a big write-up in *Ringers World*. But that would hardly impress the American National Science Foundation.

After a few minutes where his eyes were locked on the TVM's circular dial, Kip glanced up. Ahead, he saw the vaguest hint of a circle or maybe a sphere—an afterimage of the dial, he supposed. Transparent almost to the point of invisibility, the image had an ill-defined boundary, which appeared to start about nine feet above ground level. Kip moved his head, but the image didn't move. Not an afterimage, but likely a trick of the light.

As he walked toward the ghostly object, he noticed that the ground-zero tree penetrated into it—that is, if there was indeed an it. Immersed in the dense tapestry of sound, Kip observed that the object might be shimmering in synchrony with the tenor bells. He wasn't sure; it took an act of will to even see the sphere at all. And sometimes it seemed more pyramidal than spherical.

Near the base of the tree, Kip, almost by reflex, reached up with the TVM to touch the object. But there was nothing to touch, no resistance, only a near-subliminal change of color. Kip froze as the meter dial caught his eye. The pointer, no longer fixed at zero, vibrated across a quarter of its range. Kip stood on tiptoes and raised the tip of the TVM higher into the object. The meter fluctuated wildly, making soft clicking sounds as the needle pinned itself against the stops. Although uncertain of exactly what *was* happening, Kip had no doubt that a few feet above his head, something very strange was happening to time. A wave of satisfaction washed over him; his experiment had succeeded. At the same time, he reproached himself for overlooking the third dimension. Of course the effect would be significantly above ground level; the bells were high in towers.

He stuck the TVM in his belt like a sword and examined the tree for hand and foot holds. He'd climbed the tree before; he would climb it again. As he began to clamber upward, he smiled. He was taller now, but perhaps not as lithe. Although pleased with himself at how easily he climbed, he knew that, unlike twenty-five years ago, he would feel the aftereffects the next day.

Breathing heavily from the exertion as he fought for altitude, he reminisced—remembering his previous visits to the tree. He locked his mind onto one particular arboreal excursion—and noticed he was gesticulating and also moving his lips.

Abruptly, Kip realized he wasn't so much reminiscing as reliving the experience—the way one would do in a dream. Finding a familiar cleft between two branches, Kip wedged himself in. He had to think.

It could just be the hypnotic effect of the bells, but it seemed real. He experimented again, this time with his mind and his will.

Like a train on a track, he could will himself to roll back in time and relive any portion of his life. And with effort, he could live it all at once. It was as if all his past, his worldline, happened simultaneously—like photos from an album stacked and pressed together.

He took refuge in physics. Maybe there was a second dimension of time—time as a function of time: Perhaps here in the tree, time was disconnected from space. His theory said it could happen. Maybe he was experiencing the multiworld formalism of quantum mechanics.

Kip shook his head, struck with the thought that one version of the Christian heaven and the multi-world formalism might actually describe the same phenomenon. Maybe he'd been a trifle too uncompromising in his view of religion—his "fight" as Audrey called it; maybe religion was just a subset of physics.

Methodically, in his mind, he moved the lever back—experiencing his life at an ever earlier period—sharing his mind with all those other Kips. He wondered about those others; did they too experience the mind-sharing? Did they think they were perhaps having psychotic episodes? He remembered that as late as age twelve, he talked to himself—another himself.

Kip focused, pulling abruptly back from the brink. He'd felt his forty-year-old identity weaken and his eleven- or twelve-year-old self begin to assert control. He shuddered. It had been close. Yes, it might have been good to go back and relive his life, but he doubted he had the endurance to go through childhood again.

Tentatively, experimentally, he let his mind return to the brink and as he did so, noticed his hands. They were a child's hands—and his clothes were those of a young boy: shorts, tee shirt, sneakers. He inhaled, sharply—and noticed the smells, delicious smells: the pleasantly acrid aroma of tree bark, the tang of the autumn leaves, the sweet fragrance of the grass.

"Kippy," came a voice from below, harmonizing with the ever present bells. "Come down, now. You're late for dinner."

Kip started. One part of his mind experienced shock while another felt he was in trouble and would really catch it when his father got home from work. He looked down at his mom, wondering what to say. But then he noticed the bells.

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They were ringing rounds! The peal had ended and that meant the detached time effect would soon end. He had to get back to his own time or be trapped here as an eleven-year-old.

"Mom," he called out, his voice a long-forgotten treble. "I love you."

Her face, showing a puzzled expression, faded as he struggled forward in time. But now it felt as if he were running under water; already, the effect was diminishing. As he pushed ahead against an ever increasing drag, he took some comfort in the notion that if he didn't make it, he'd still be able to live at normal speed and eventually get back to where he was. But then, he shuddered with a horrible thought; if he didn't get back, he'd be in an endless time loop: reliving his life to the point of doing the experiment, then going back and living it again—and again and again. But maybe not! Maybe he'd manage to do just one different thing this time. That might be all he needed. Like bobs in a ringing method, it might change everything. He held firm to that hope as memories of the future faded to memories of memories and then to dreams.

He fought his way forward and wondered how old he was. What a stupid thing to wonder. He was fourteen.

"Hey, Kipper!"

Kip looked down, then hooked his legs over the limb and swung over, letting his arms dangle. "One for all," he said, hanging upside down, "and all for pickles."

"Geez," said Malvyn, astride his bicycle. "Last time I heard you say that, you were eleven."

Kip chuckled, then grabbed a limb and vaulted to the ground like a gymnast.

"Glad I found you," said Malvyn. "In honor of your not winning your fiddle scholarship, we decided we'd treat you to some goodies at Beowulfie's."

"Hey, that's really neat," said Kip. "You and Nev?"

"Yeah. His idea." Malvyn pumped his hand brakes, a sign he was anxious to get moving. "He said he'll meet us there at two. And why I'm glad I found you is because if I hadn't, Neville said I'd have to treat *him*."

Kip raised his bicycle upright from the grass and wheeled it next to Malvyn's. "I'm glad I didn't win it," he said, quietly.

"What?" Malvyn practically squeaked.

"I've decided I don't really want to be a concert violinist."

"Geez." Malvyn shook his head. "You know, Kipper, I don't understand you."

"Yes, I know." Kip shrugged. "Sorry."

"Boy," said Malvyn. "For the last month, you've checked your mailbox ten times a day, and talked us to death about how you wanted that scholarship more than anything in the universe. And now you say you're glad." Malvyn stretched his arms imploringly to the heavens. "Geez."

"I've decided that science is more important to me than playing the violin." Kip mounted his bicycle but kept one foot on the ground. "Anyway, I can play violin as a hobby. And I don't think you can be a scientist as a hobby." He leaned over and glanced at Malvyn's wristwatch. "We're too early for Wulfie's."

"Okay." Malvyn leaned his weight on a pedal and set off. "Let's go over to the tower."

Kip set off as well. "Yeah. Maybe we can sneak into the belfry and untie a bell rope or something."

Malvyn looked back over his shoulder. "Not bloody likely!" He pedaled slowly, letting Kip roll up along side. "Last time, my dad caught me. He nearly tore my head off." Malvin scrunched up his shoulders as if he were in pain. "And if he catches me again, I'm toast."

"So you've sworn off belfry visits?"

"Not exactly." Malvyn laughed. "I've just got to be a little sneakier about it."

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"Too late, anyway," said Malvyn. "They've started ringing."

"Only rounds."

"You know," said Malvyn as he pedaled steadily on the road into town. "I'm sort of glad you didn't get the scholarship. Keeps the Musketeers together. And Audrey would have missed you."

"Really? How do you know?"

"She told me."

Kip pressed down on the handbrakes. "Malv," he called out, "stop for a moment, will you?"

Malvyn cycled in a graceful curve and pulled up next to Kip. "What's wrong?"

"Did she really say she'd miss me?"

"Audrey? Yes. She did."

Kip looked down and worked the handbrakes a few times. "You . . . You know something about girls."

"Yeah, a little. Why?"

Kip continued working the brakes, but didn't say anything.

Malvyn laughed. "I know. You want to ask Audrey out, but you're too shy to ask." He laughed again. "That's it, isn't it?"

Kip felt himself blush. He still didn't say anything, but just listened to the bells.

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"Look, it's not so hard," said Malvyn, sounding now like a helpful older brother. "Just ask her. I bet she's wanted you to ask her for a long time."

"You think so?"

"Yes!"

With a show of resolve, Kip looked up. "I *will* ask her," he said. "I'll do it today."

Malvyn placed a hand on Kip's shoulder. "Believe me, my boy," he said, mimicking Mr. Caruthers' voice and mannerisms, "it will change your life."

"Change my life." Kip laughed. "Yeah, right."

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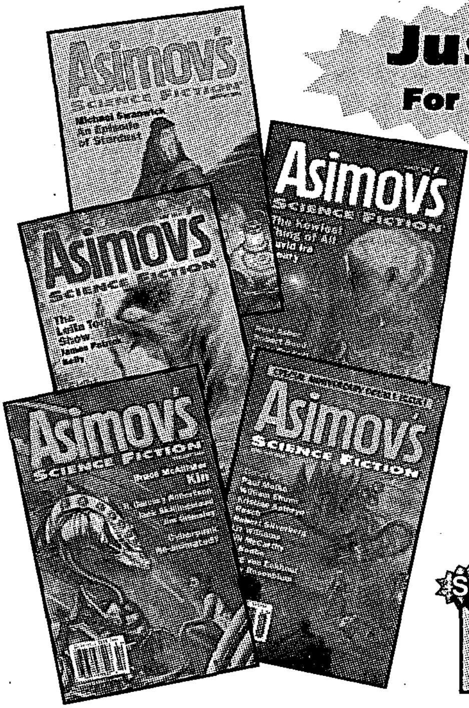

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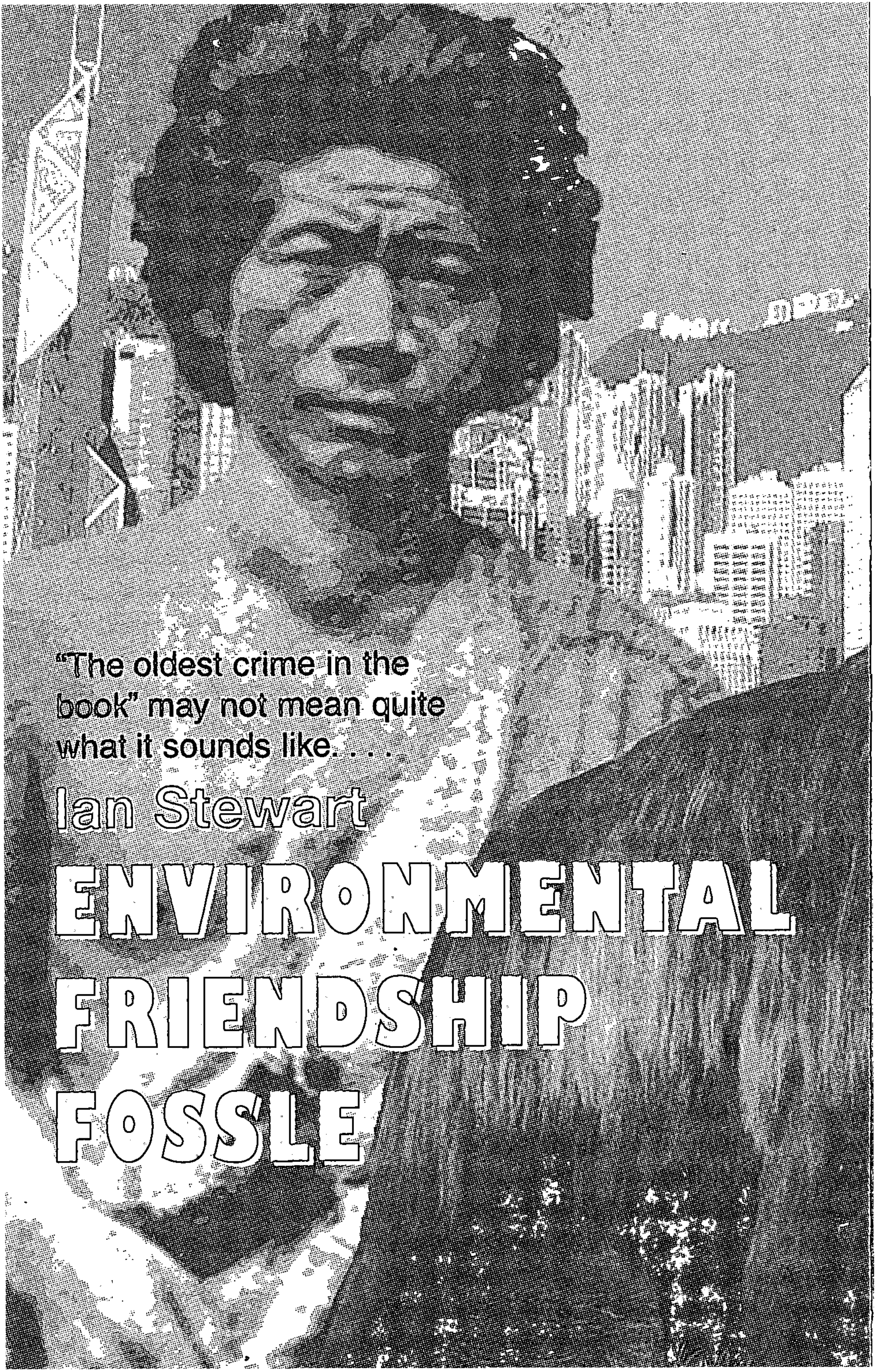

"The oldest crime in the book" may not mean quite what it sounds like. . . .

Ian Stewart

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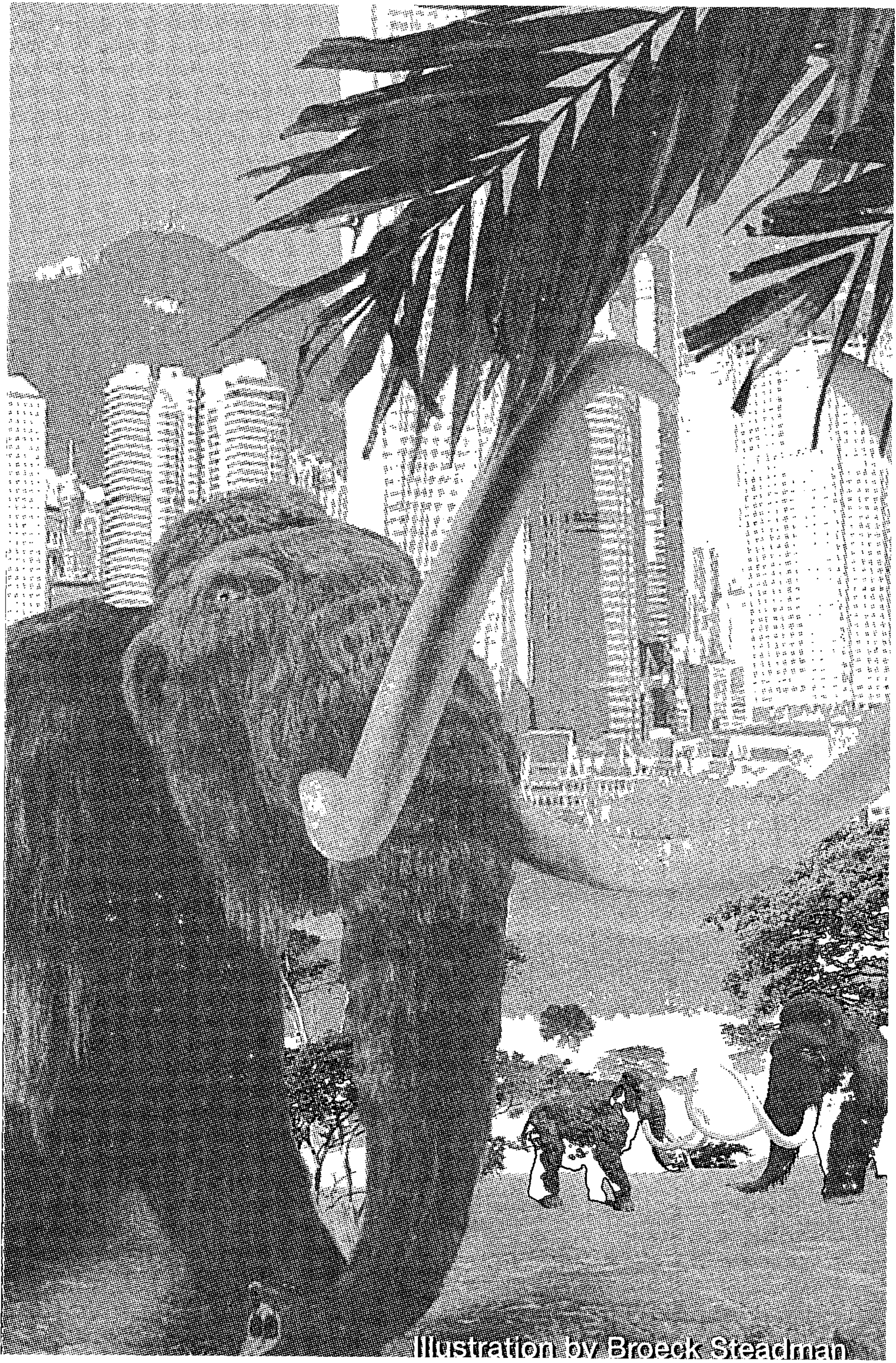


Illustration by Broeck Steadman

It happened so fast that I nearly missed it.

I'd seen the kid hanging about near Wang's stall, with a studied nonchalance on his face and a hardness in his eyes, but a lot of the street urchins do that and it's not illegal to look at tourist trash without buying any. And I can usually tell the thieves from the hopefuls—some kind of sixth sense, born of long practice.

This time, my extra sense let me down.

The kid was good, I have to admit. Wang Chin-Li was distracted by a potential customer, a willowy blonde just flown in from Amsterdam, still red around the eyes despite recent applications of eye-shadow and mascara. She was deciding whether to buy an expensive jade rabbit, and Wang, who has a bit of a thing for tall Western women and even more of a thing for their money, wasn't quite as alert as he would usually have been.

I only caught the actual act of theft out of the corner of my eye, because at the time I was trying not to trip over the old man.

I didn't know his name. You could usually find him, sitting in a small, none too clean alcove by the entrance to the butcher's shop across the road, dismembered ducks hanging from metal hooks, thick slabs of animals I couldn't identify, watching the world go by. He'd sat there almost every day for the last three and a half years, to my knowledge, and he looked old enough that for all I knew he might have sat there for the last fifty.

He didn't beg, he didn't talk, he didn't look unhappy. He just sat. Overhead, the Shelley Street escalator bumped and ground its raucous way towards the middle levels and beyond, all the way up to Conduit Street where the middle classes hung out. It was late morning, so the direction was up. In the morning rush hour it was down. Sometimes, and they were getting more frequent as the machinery slowly fell to bits, it didn't go either way. Then the locals started walking and the tourists started fretting. But today a steady stream of people glided up the slope, like Jesus walking on diagonal water.

The old man never acknowledged the escalator, the travelers, or me. He had sparse gray hair protruding in tufts from the edges of a flat denim cap that had seen better days. Rheumy eyes matched the faded blue of the cap. When he stood, you could see that his left ankle was frozen and his knees were none too sound either, but he didn't stand often, or for long. I noticed what the kid was doing when those eyes, suddenly imbued with life, flicked sideways. I tried to grab the little bastard's sleeve as he ran past, heading for one of the alleys down to Hollywood Road, but he avoided my clumsy lunge and darted away between the vendors' stalls, agile as a monkey. There was a shout from the woman who sold bags of unidentifiable sea creatures, dried and dyed, as a pile of what looked like pink teabags tipped over and spilled across the uneven stone steps.

Then he was gone.

"Sorry," I said to Wang. "I'm getting slow in my old age. It's the reflexes that suffer."

The sea-creature lady started scooping up her teabags—swim-bladders from some unidentifiable fish, probably. Waste not, want not. Protein is protein.

"No, I've seen that kid before," said Wang, bowing apologetically to the sea-creature lady. He spat. "A cheap little *ma jai* who pretends he's a *dai dai lo*. Very quick on his feet, too quick for the likes of you and me. Even quicker with his thieving paws. He'll grow up to be a fine young pickpocket, if you want my opinion."

Ma jai means "little horse," and it's the lowest level in a street gang. At the top is the *dai dai lo*—big, big brother. Most gangs are affiliated to triads, Hong Kong mafias, with a *shuk foo*, uncle, as their triad liaison officer.

Gangs are a nuisance. Triads are

dangerous.

Wang brushed his hands against his jacket, sewn in the sweatshops of Shenzhen Special Economic Zone, *a.k.a.* Shenzhen Sweatshop or Counterfeit City, a few miles across the border with the People's Rep. "It was only an ivory pig, Mike. Sells to tourists for fifty dollars, costs about two to make."

The Dutchwoman would have found this information fascinating, but she didn't speak Cantonese, so she carried on rummaging through the trays of carved wooden animals.

"Ivory."

It was a long moment before I realized that the old man had spoken. It was the first time he'd broken his silence since I'd been watching him.

"Not real ivory, grandad," I said. "Mammoth ivory—see the sign?" In the window behind the stall was a faded yellow card: ALL OUR IVORY IS ENVIRONMENTAL FRIENDSHIP FOSSLE FROM REAL MAMOTH TUSK. There was a time when the signs had said one thing and the ivory was something else, but after the Sino-African Conservation Treaty of 2016, the flow of illicit elephant and rhino tusks into China had pretty much dried up, and Wang's funny little animals very probably had been carved from the fossilized bones of Pleistocene mammoths and mastodons melted out of the Siberian tundra with jets of superheated steam. I hoped so, because that way I wouldn't have to arrest him. The paleontologists were none too happy at this development, but at least no noble beasts were getting slaughtered to make tourist trinkets, and the economy of the Siberian Collective had improved enough to stop them slaughtering Russians, most of the time, so I figured there was a significant net gain.

"Mammoth ivory," the old man stated, as if it was a proposition put up for debate. "I have hunt mammoth."

As a reminiscence, it was a lot more interesting than most old men's utterances, but no more plausible than tall tales of mermaids and dragons, or sexy blondes in bars, come to that. "I can see you're old, grandad," I told him, "but not *that* old." He probably meant "elephants." "Did you hunt the mammoths in Africa?"

"In Siberia," he insisted. "When I was still able to move without pain." His accent was strange, sounded vaguely . . . Mongolian? Perhaps he had been to the Collective, long ago. But not long enough for there to have been mammoths to hunt.

"Ah, the famed Siberian elephant, the terror of the Steppes," Wang joined in, giggling. Possibly with embarrassment.

The old man waved his hand dismissively. "Young people got no respect for their elders no more," he complained. He turned his back on us and returned to some inner contemplation—I wondered what he saw in his mind's eye.

Mammoths, maybe.

Salima was waiting for me at Speedy's, a tiny eatery with an even tinier kitchen, not quite hole-in-the-wall but that was mainly because there wasn't room for a wall. It had a bar, a row of wobbly tables on plinths, a couple of extra tables jammed into what counted as spare space, and a few stools lined up against the window, which was always wide open. You could get passable Mexican food at the Speedy Gonzales restaurant, and a pretty good margarita for the lowest price in Hong Kong. Great cuisine it wasn't, but it filled the gaps and beat the pants off the rather bland offerings that the Cantonese like to eat. My jaded palate needs something with a bit more *zing*.

Salima had zing, and better still, she had a first-class brain. Her mother was Cantonese, her father Egyptian. Both had died when she was a teenager—train crash, maglev failure. It could have destroyed her, but it brought out her fighting instincts, made her tough and independent. She'd worked her way through college, and was currently doing a part-time Ph.D. under a certain Professor Zhao in the Paleontology Department of Hong Kong Polytechnic University. Her topic was mesolithic hunting and its contribution to extinctions, and she was paying her way by acting as one of Zhao's lab technicians. His department hadn't existed twenty years ago—Hong Kong does have a few fossil species, but nothing worth setting up a department for. But when control of Hong Kong reverted to the People's Rep, the University of Shenyang set up a satellite operation at HKPU to take up some of the workload generated by the Yixian sediments in Liaoning Province, and Zhao had been hired from Beijing. The list of important fossils that have come out of the Yixian deposits is as long as a Diplodocus's backbone, and considerably more significant for the history of life on Earth, I gather.

Right now, Salima's income derives from cleaning up dinobird remains. Zhao had spent several years in northern Asia, which is where he'd first gotten interested in the effects of mesolithic hunting. But as soon as the Liaoning dinobird remains were discovered, he returned to Beijing and started working on the Cretaceous-Tertiary boundary. His long-term aim was to document the precise sequence of events that killed off the dinosaurs. But he'd kept the Pleistocene research going, too.

Over two burrito supremes (that meant they came with guacamole *and* sour cream) we caught up on each others' days. She'd spent hers cleaning up one leg-bone of a fossil *Confuciosaurus*. Apparently an entire flock of them had dropped out of the sky one Late Jurassic afternoon, probably caught in a cloud of carbon monoxide from a nearby volcano. They'd splattered into the mud of a lake and ended up as strata.

"But the really exciting news," she said, breaking off in mid-flow, "is the new mammoth graveyard near Yerekhtenya-Tala. I should be able to get really good data if Zhao swings us access to some specimens."

"I'm sure you'll pester him until he does. Graveyard?"

"Well, it's not really a graveyard—I mean, the mammoths weren't buried deliberately. But there are so many frozen corpses that it looks like one."

"Ah."

"What's fantastic, aside from the sheer number of animals, is that they all date from the end of the Pleistocene."

Clearly the timing was significant, but my ignorance must have registered on my face, for she quickly explained: "That's 9,000 BC, Mike. Soon after that, the mammoths went extinct. Well, some tusks from Wrangel Island seem to be younger, but *Mammuthus primigenius* was extinct by then over virtually the whole of its historical range—"

I gave her a quizzical look and reached for a handful of tortilla chips.

"Sorry. Woolly mammoth. The significant thing is, wherever woolly mammoths coexisted with humans, be it Siberia or North America, we find kill sites with lots of mammoth carcasses. The evidence that they *are* kill sites includes flint tools and mammoth bones with cut-marks. The animals were butchered. But we don't know what effect hunting had on the population dynamics. What I'm hoping to find is evidence of increased or more effective hunting at the end of the Pleistocene. Or not. Either way, we'll learn more about the mammoth extinction.

"But enough about me. How was your day? Catch any smugglers?"

Salima is one of the few people who know how I make my living. Most of my friends and acquaintances think that Michael Crow is basically just a bum who hangs around Hollywood Road because he's got nothing better to do with his time. To some extent that's true . . . but what they don't know—and I hope never find out—is that I have a part-time contract with SCITES. That's the Second Convention on International Trade in Endangered Species of Wild Flora and

Fauna, you'll recall. It's mostly a bureaucratic nightmare, but it has an Enforcement Agency, which monitors trade in endangered species and bangs up anyone who breaks the rules or is complicit in breaking the rules. Nowadays it's mostly the demand for "traditional medicines" that causes SCITES headaches in these parts; nobody would dare to try to sell a tiger-skin rug anymore, but ground tiger bones and powdered tigers' testicles as a cure for everything from warts to brain tumors are a different matter entirely. Of course no one advertises such products, but a few winks and nudges are enough to convey the message to a prospective customer. It doesn't make things any easier for the Agency that most what's sold is fake—the bones are often from the cat *family*, but small ones that go "miaow" rather than enormous ones with stripes. It's not illegal to sell ground cat bones, and no one ever claimed they were from tigers, now, did they?

What really bug me are idiots who try to buy rhino horn. They can get Ciagris over their wristbands, and that mostly *works*—unlike suggestively shaped bits of dead rhino—so what's the point?

I'm kind of leery about anyone knowing what I really do, because most of the trade in endangered species is run by the triads. In conjunction with their Chechen, Kazakh, Tajikistani, and for all I know Tasmanian equivalents. I have no ambition to end my days as part of the next bit of reclaimed Kowloonside harbor. So mostly I keep tabs on what's going down, buy occasional samples from medicine shops and tourist traps, pass them on to SCITES to be tested, and maintain a low profile.

You can see how much I trusted Salima. I'd been trying to get her to move in with me for the last two years, and we had few secrets from each other now.

She was wavering, I knew it.

My mind kept coming back to what the old guy had said. *Hunting* mammoths? More likely a solid case of Alzheimer's, I thought. But, it kept bugging me. What on Earth was he gabbling about? Was there some nasty truth behind it—elephant poaching, for instance? Raids on zoos? Or was it just senile rambling?

Shit, who cared?

To my surprise, I realized that *I* did.

I looked for the old man the next time I passed by Hollywood Road, but for once he wasn't there. The steps of the butcher's shop were empty except for black plastic bags of whatever bits of animal even the Chinese considered inedible. Several wet-looking lumps and stringy things had spilled out of the bags, but for all I could tell, they might have been the burial remains of an alien from Fomalhaut.

That was a thought. Had the old man been abducted by aliens, and hunted mammoths that had themselves been abducted anything up to 150,000 years earlier?

I decided it wasn't a very *good* thought.

Wang saw me staring at the butcher's shop steps. "He's dead, Mike. Feng told me." Feng was one of the butcher's employees. "Apparently the old guy was some kind of distant relative of Feng's. When he didn't show this morning, Feng called his home, got through to one of the paramedics from the ambulance instead."

I gave this some thought. "Does Feng know his address as well as his phone number?" I thought some more. "Dammit, Wang—can he tell me the old man's *name*?"

He could. It was Tsong: good solid Chinese name. Except that he was Tsong Kapa, and that was rare outside the Xizang autonomous region. Formerly known as Tibet.

Tsong's apartment was on the thirty-ninth floor of a dilapidated high-rise on a reclaimed section of harbor near Tai Kok Tsui. I had a valid search warrant in my pocket, obtained through the Agency's contacts at Police HQ, and after lengthy scrutiny and a wristband call to senior management it entitled me to an entry card from what was laughingly called the concierge desk.

I slid the card into the lock and pushed the door open. There was a faintly musty smell, no doubt because the windows were closed but the air-conditioning was switched off. The apartment was hot, humid, and small. Westerners would have called it cramped, but in Hong Kong terms it was, if not palatial, ample for a single person. Often an entire family, plus Filipino maid, would have occupied a smaller space.

I pulled on rubber gloves and searched the whole apartment. It didn't take long.

There were the usual consumer electronics—small, Japanese, stylish. A flatscreen, an mp5 player, an old-style wristband-to-landline socket in the wall, a battered deskcomp with wireless Net connection. I couldn't crack the password—I'd have to leave that for the IT fraud squad, who would be very interested indeed to find out whether there was anything incriminating on it.

There were no books, no photographs. An acrylic painting of a bull elephant silhouetted against a Kenyan sunset hung on one wall, slightly lopsided. In the tiny closet were some drab shirts, a few pairs of worn trousers, and a couple of threadbare jackets.

The furniture was cheap and ordinary, most likely bought second-hand. Tsong Kapa had led a simple life. Except—

Under the single bed, with its thin, hard mattress—how do the Chinese sleep on those things?—was part of a tusk. Looked like elephant, a young bull, sawn off at the thick end, two-thirds the length of the bed. It was wrapped in pink tissue paper.

I lined up my wristband and took some photographs—bed, tusk, clothing, apartment. Painting of elephant. Pink tissue paper.

Then I called the Agency, who would pick up the tusk, dust for prints, and take the apartment to pieces. I was stuck there until they arrived, holding the fort in case someone came and took stuff away before SCITES got there.

I stared at the walls, trying to put myself into Tsong's frame of mind . . . If I'd wanted to *hide* something, where. . . ?

After a while, my eyes were drawn to the suspended ceiling. One lightweight tile looked dirtier than the others, as if it had been handled, repeatedly.

I dragged a chair across, stood on it, and pushed the tile up into the roof-space above. The space was shallow, and the glow from my wristband's screen showed it to be empty. The dirt was a red herring. But I tried the other tiles in turn, slipping them out past their supports, and taped to the back of one of them was an envelope. Inside the envelope was an old-fashioned metal key. Stamped on the key were the digits 244, in Western characters.

I put the key back in its envelope, slipped both into my pocket, turned the flatscreen to a People's Rep basketball channel, and settled down on the couch for the Agency squad to turn up.

It was a long wait.

"Salima—what kind of key do you think this is?"

She was used to me asking this kind of off-the-wall question, just as she was used to me trying to make our relationship more permanent. She took the key between thumb and nail-varnished forefinger, turned it over, held it at an angle to the light, as if it were some paleontological specimen. Perhaps it was.

"You don't see many metal keys these days," she said, her voice muffled by a soft taco.

I nodded. "Encryption is more effective."

"Right. But this is no antique, Mike. Looks fairly new, but well-used."

"What makes you think that?"

She put down the taco and sipped at her drink. She had a sensuous mouth. "Plenty of bright metal, but also plenty of scratches," she said.

I thought about that. "Locker?"

"Yes. Could be a garage, but most likely a locker. Most of those still have metal keys. Too expensive to change to cryplocks, and not much point anyway."

"That's what I think, too. A locker is a good place to keep something you don't want in your own home. Drugs, pornography, whatever. Not an airport locker or a bus station one—those are checked regularly by the authorities. A garage key would be unlikely; he wasn't rich enough to own a car. Though it could be someone *else's* garage."

Salima stared at the key, as if willing it to give up its secrets. It did. I saw the smirk spread across her face.

"Come on, girl. Give."

"Buy me another margarita."

"Deal." I beckoned the waitress over. Salima liked hers frozen, no salt. On the rocks for me, with salt—bad for your heart, I've heard. I'll risk it.

"A gym," said Salima, once her drink had safely reached our table. "Very likely a university one. You see this bit where it's been scraped?"

"Yes. So?"

"They put a strap on it so you can Velcro it round your wrist. The tag runs through a metal ring. Someone took the ring off, scraped the metal."

I stared at her. "You can tell all that from a few scrapes and scratches, Ms. Holmes?"

"Not exactly. I've used a key just like this myself. At the gym on Pok Fu Lam road."

"Do 70-year-olds train in gyms, Salima?"

"My grandad ran marathons, Michael."

The key didn't fit locker 244 in the men's changing room at the gym on Pok Fu Lam Road, but I got the janitor to open it anyway. It contained one sweaty sock and a packet of condoms, only two left out of a dozen. Still in their foil wrappers, which was a mercy.

I wondered about the women's changing-rooms, but that would have made it difficult for Tsong to gain access. Ruling that possibility out for now, I asked the attendant whether there were any other university gyms. He told me there were two more. One was in Happy Valley; the other, in Sha Tin, was closed for renovation. An hour being shuttled from official to official secured me master keys to both buildings. On a hunch, I started with the one being renovated.

The key fit—no need to try the other possibilities, then. Locker 244 contained a tin box. I picked the lock, and inside was a media card from an outmoded digital camera—either a Ricoh or, more likely, a cheap Shanghainese copy. Not drugs, then; those had never been more than an outside chance anyway. Something much more interesting.

My heart was thumping fit to burst—and I didn't think the salt on my margarita was to blame.

The card went straight into my pocket, sealed inside a static-free envelope. This was what Tsong had taken so much trouble to conceal. I wondered what was on it. I couldn't understand why, having hidden something as small as a media card, he had taken such a risk with a tusk. I totted up possible reasons. One: a tusk wouldn't have fit into a gym locker. Two: he was 70, when logic is not at its peak. Three . . . if it was a mammoth tusk, not elephant, there was no risk involved. Perfectly legal, environmental friendship fossle. Who would ever believe otherwise?

If it was a scam, it was a beauty.

Was the tusk really mammoth? I had no idea.

Why hide a smart card from an antique digital camera? I could think of lots of plausible reasons, but the best way forward was to find out what was *on* the thing.

At home I have a special card-reader attachment for my wristband, which recognizes obsolete formats and translates them into iPEG. So I went home, downloaded the files from Tsong's card, and brought them up in FotoSwap, my mouth dry, my pulse racing.

The quality was excellent, the lighting strangely dull, the skies smeared with clouds in multiple shades of gray.

There were individuals, standing, sitting, lying on the ground.

There were groups. Young and old together.

Not pornography. The authorities on the mainland are hot on that, but Hong Kong is fairly relaxed except for kiddie-porn, which this thankfully wasn't. The individuals and groups looked like woolly elephants. Either they *were* woolly elephants, or they were genuine *Mammuthus primigenius*.

Some were living. Most were dead. The dead ones were all bulls, and most of them had gaping wounds where their tusks should be.

Several of the men in the photos were carrying guns. I recognized the brand immediately: AK-83 assault rifles. The originals were Russian, but these had most likely been manufactured in back-street machine shops in Kabul.

Some frames showed piles of tusks roped to battered Toyota trucks, no registration plates. A few showed tusks being hacked from their owners using chainsaws. And in three of the photos, the man holding the chainsaw looked a bit like Tsong. Younger, I'd guess early forties, but the face and hands were familiar.

Sweat broke out all over my body. The old man *had* hunted mammoths. Somewhere.

What had I gotten myself into?

~~Lies.~~

~~Shaggy mammoth story.~~

~~Senile old goat.~~

~~Other ways to go nuts.~~

~~Hypnotism.~~

Cloned mammoths.

Genetically modified elephants—ivory looks like mammoth.

Aliens who abduct(ed) mammoths.

Aliens who abduct(ed) cloned genetically modified elephants.

Chemical process that makes elephant ivory look like mammoth.

~~Synthetic ivory.~~

~~Drugs inducing the illusion of hunting mammoths.~~

Virtual reality mammoths.

Resurrected mammoths.

Alien creatures resembling mammoths, hunted on Earth.

Alien creatures resembling mammoths, hunted off Earth.

Robot mammoths. Cybermammoths. Mammdroids.

The brainstorm file on my wristband went on for several pages. I looked at the list for the hundredth time, sighed, and closed the file. I had plenty of wild theories, very few facts, and nothing made any sense whatsoever. The first few theories had been the most likely until my search turned up the tusk, but now I'd deleted them, leaving the remnants in case something caused me to reinstate any of them.

Everything about this business smelt of organized crime—a mainland tong, a Hong Kong triad. I was treading on dangerous turf. Not for the first time.

I was having the tusk tested, through SCITES, to find out what animal it was from. Privately, I was betting on "elephant." The test wouldn't tell me whether the elephant had been the proud possessor of a woolly coat, but the photos were enough evidence of that.

Some theories I could rule out by making other tests on the tusk, as I intended to once I'd gotten the results of the first test. For instance, if the tusk had been made by a chemical process that makes modern elephant ivory look like fossil mammoth ivory, the result almost certainly wouldn't be perfect. The fine detail of the ivory's structure, under a microscope, would be a dead giveaway. There might even be traces of the chemicals used.

Other theories were more problematic. For instance, if someone had managed to clone mammoths using preserved DNA from the Siberian tundra burials, would it be illegal to slaughter them for their ivory? SCITES had made that illegal for *bona fide* elephants, but I didn't need to read the treaty to know that it did not mention live mammoths.

Could we argue in court that a living mammoth was really an elephant? Could that argument succeed? I'd seen sillier unorthodox interpretations stand up in a court of law. I'd seen more sensible ones thrown out.

Suppose Tsong had unknowingly hunted robot mammoths, as part of some elaborate scheme to make him think he was hunting the real things. Fake mammoth ivory, chemically transformed from real elephant ivory, would have been implanted in the robot's tusk, so that he *thought* . . .

Crazy. *Why would anyone bother?* Why would it matter if Tsong thought he was hunting mammoths? Anyway, the old guy was dead and the chances of tracing the triad behind this scam were zero, let alone pinning it on them in court. I'd gone too long without sleep, I was losing my mind. Every explanation was either incredible or stupid. What did I really have? An offhand remark made by an elderly expat Tibetan who was probably suffering from dementia, some images that any nine-year-old could pull off the Net and fake up with FotoSwap, and a tusk that would probably turn out to be made of plastic, carefully wrapped in pink party paper. The puzzle that I was allowing to consume me was thinner tissue than the pink paper. Mist, dreams, delusions—

Then my wristband flagged a call. It was a woman's voice, American, east coast. Marcia White, head of SCITES' Analytical Branch.

"We have a positive ID for your tusk," she said. "It's mammoth." So I'd lost my private bet.

I flicked through my brainstorm file, and a thought struck me.

This was *definitely* a long shot. "Can you do me a favor, Marcia?"

"Depends what it is."

"Carbon-date the tusk. I'd like to know how old it is."

She hesitated, but didn't ask any questions. "Yes, I suppose that information might help identify the source. I'll let you know when the result comes through."

Two days later, she called again. SCITES had finished testing the tusk—but their Chief Analyst refused to tell me the results over a public channel. Could I come to her office in person?

I asked why.

She wouldn't discuss *that* over a public channel, either.

I looked at my watch: it was twenty to eleven. I could take a red retro Toyotaxi to the ferry terminal, a ferry across Victoria Harbor—you never had to wait long for a ferry—and another taxi. That would be a lot cheaper than paying to use one of the tunnels under the harbor. A taxi would be quicker than a magbus, and only marginally more expensive.

"I'll be with you around noon," I told her.

SCITES has a suite of offices between the 45th and 48th floors of the HKBBC Building in Ma Liu Shui, overlooking Tolo Harbor. The picture window in Reception frames a view of the jagged, foliage-covered hills of Sai Kung Country Park, to the right, and Plover Cove Country Park, to the left. As always, both were half-hidden by a haze of pollution wafted in from the mainland industrial zones. I showed my ID, checked in, and within a few minutes I was being offered green tea and some tired looking *dim sum*. I accepted a cup of tea, and Marcia handed me a sheet of paper, a standard lab analysis form. I looked at the brief report.

"Marcia, this makes no sense," I said.

"I know," she replied, no smile, very businesslike. "That's why I didn't want to discuss it with you on your 'band."

"Oh. I thought maybe it was something you wanted to keep secret."

"No, I just didn't want to waste my time arguing over a bandlink when we can argue much more efficiently in person. I figured that telling you nothing would push all your curiosity buttons and get you over here double quick."

"Thanks," I said. She *still* wasn't smiling. "That was really thoughtful of you."

She didn't acknowledge the sarcasm. This lady was *focused*. "So, what do you think?" she said.

I tried to conceal the fact that I hadn't got a clue. "It's *modern*?" I asked inanely.

"That's what the report says. Carbon dating puts its age at around 30 years."

"And it's definitely mammoth?"

"No question."

This was crazy. "No chance of any errors?" She shook her head. "Right. Uh—anything from the old guy's deskcomp?"

"Still trying to crack the crypto. It takes time. We'll get there." SCITES had access to a cryptanalytic quantum computer, massively parallel and able—in theory—to beat the Turing limit. In practice, making it work was something of a black art.

I sighed. "Not a lot to go on, then. If I had to guess, I'd say someone's cloned a mammoth. *Jurassic Park* rides again, but this time it's Pleistocene Park."

She pursed her lips. She looked worried, as well she might. "It's as good a theory as any, Mike. Like you, we really have no idea. It's baffling. Everything we think of is wild."

"If somebody—some organization, probably a triad—*has* cloned a mammoth, Marcia, we've got a problem. We'll be so busy inspecting ivory that turns out to be mammoth that we won't spot elephant ivory being sneaked in as part of the same consignment. We can't test everything."

Marcia stared at me. Maybe I'd finally said something sensible by accident. "Why would anyone clone a mammoth?"

"Because . . . because the sweatshops stopped using real elephant ivory for carvings a while back. It fetches a much better price from the cartels that supply traditional medicines to the hole-in-the-wall pharmacies; the price went sky-high a few years ago when someone decided that whatever a rhino horn can do, an elephant tusk can do ten times better." I sighed. "Why do people fall for visual puns? It's like using a melon to cure a headache because it has the same shape as a skull. . . . Anyway, the upshot was that nowadays, the ivory-carvers can't afford elephant."

She nodded, once. "So elephant ivory is worth a fortune. Whereas fossil mammoth ivory is not believed to have any medicinal value."

"Precisely. Even though it's the same shape. Hell, it doesn't have to make sense, Marcia. If that were a criterion, there wouldn't *be* any traditional medicines. Fossil ivory is relatively cheap; that's why it's used extensively in tourist trinkets."

She grunted. "So why did anyone go to the trouble of bringing *this* tusk into existence?" She poked a finger at the pink tissue paper. "Why not clone elephants instead, and sell *their* ivory to the cartels?"

My mouth got ahead of my brain. "That would . . . bring them into conflict with the elephant-ivory smugglers, which is the quickest way to sign your own death warrant that I can think of," I said. "Those people outrank even the triads on the streets. So whoever it is—probably a new start-up, maybe a mainland tong trying to expand its patch—they horned in on the mammoth ivory trade instead, no pun intended, sorry. Cloning fresh mammoths is easier than digging fossil ones out of the permafrost. . . . They're not so easy to find any more, the Siberians are talking about an export ban—"

She laughed, without humor. "Or none of the above."

Salima was always willing to talk about her thesis project. I listened while she told me about the Maori extinguishing eleven species of moa and the theory that widespread burning by Australian aboriginals had changed the continent's micro-climate and wiped out hundreds of indigenous species, mostly insects and birds. Then I guided the conversation towards what really interested me.

"Mammoths? There are dozens of theories, but they come in three main flavors. Climate change, disease, and hunting by humans. We know that the mesolithic inhabitants of what is now northern Asia hunted mammoths—there are even flint spearheads embedded in corpses preserved in the ice. There are massive bone deposits at the foot of cliffs, and evidence that entire herds were driven over the top. But the orthodox view is that hunting alone would not have been sufficient to make mammoths extinct. *Homo sapiens* didn't have that capability at that time."

"I bet it *was* hunting," I said. "How much of that belief is based on evidence, and how much is political correctness, Salima?"

She chuckled. I like it when she does that. "Bit of both. There's a romantic tendency to assume primitive peoples lived in harmony with nature, taking only what they needed, respecting their environment—"

"Speaking of romantic tendencies," I broke in, "how about we—"

"Don't interrupt. Ask me later. Uh—where was I? Oh, yes. Sometimes they did—respect their environment, that is. There are island populations with limited resources, continuing almost unchanged for thousands of years. But when resources are abundant—when hunting is easy—humans take everything they can get, whether they need it or not. They'll butcher a moa to get the best meat, throw away the rest."

"How can you tell what bits they ate?"

"Cut marks on the bones—rather, their absence."

"So it could have been hunting that killed off the mammoths?" I persisted.

"It's possible. But the profile doesn't seem to fit. Killing technology was pretty primitive in paleolithic times—it must have been around for so long that overhunting should have finished off the mammoths around 50,000 BC. But they were still present, in quantity, until about 10,000 years ago. *Ergo*, it wasn't over-hunting."

"It's all a bit circumstantial, Salima."

She gave a wry smile, nodded. "Tell me about it."

"If it wasn't hunting, what was it?"

"Could be disease, but it would be almost impossible to find evidence for that. Could be climate change, that's very plausible. Mammoths flourished during interglacials, and some managed to adapt when the ice came down from the north—hairy coats, that kind of thing. But a lot didn't, in my opinion. There was some migration, but the vegetation wouldn't have been so suitable elsewhere. . . . The population must have crashed as the feeding grounds became buried in thick layers of snow, then ice . . . we do have some evidence from fossils. As the habitat contracted, so did the population." She didn't look convinced.

"Maybe it was both," I suggested. "The cold climate reduced the population below some critical level, and then, over a couple of millennia, hunting finished them off."

"Could be. It's a standard idea; most extinctions are multicausal. Maybe the mesolithic technology improved, too. The end is really rather abrupt. The new graveyard seems to be the result of a mass die-off in very short period of time, paleontologically speaking. Before that discovery we only knew of about fifty frozen corpses, scattered all over the place. Now we've got over a hundred in one spot. Which reminds me, Zhao has arranged to be sent samples from all the specimens. He wants me to do some comparative DNA analysis, see if I can figure out the diversity of the gene pool, estimate the population size. If it works, he'll apply for a grant to do a much larger study."

"I don't suppose any of your samples still have tusks?"

Salima shook her head. "There are no tusks anywhere in the deposits. They seem to have been hacked off. More evidence of butchery. Presumably the ancient hunters used the ivory for carvings, or traded them with people who did."

She leaned forward, resting her chin on her hand. "There is one odd feature, though." Whatever it was, she looked unhappy about it. "The grapevine says that aside from the missing tusks, no one's found any other signs of butchery in the graveyard deposits. Those hunters didn't kill for meat." Her face brightened. "Which, now that I think of it, suggests that the motivation for mass hunting changed around that period. Which could be very significant for my thesis."

I'd expected Marcia to look a little more relaxed, under the circumstances. Cracking Tsong's crypto ought to have been a big step forward. But she was distinctly edgy.

Together, we stared at the image projected on the screen. It showed a jumbled mass of text, in Chinese characters.

"Notebook file?"

"Diary," she said. "It gives a fragmentary but quite comprehensive account of a mammoth-hunting expedition."

"Aha! So someone *has* been cloning mammoths!"

She shook her head. "That's not clear. In fact, what's in his diary is so unbelievable that absolutely nothing is clear."

She turned her chair to face me. "And even if it were clear, there's no way we'd ever get a conviction out of it."

"Why ever not?"

She swiveled back to face the screen. "Let me show you."

18 September 2021. The winds howl stronger than in Gyangxe Valley, but the air is thick. There are mountains, in the distance, but they are not the mountains of Qomolangma. This place is not my homeland. Yet it is no more than half an hour's drive from my home in Rongpu Si. The windows of the truck were blacked out, so I could not see where we drove. I am frightened. This place should not exist.

I must ignore my fear. Tenzin and the children are close to starvation. I need money. So I sit in the cold and oil the Kalashnikov they have given me.

21 September. The guests have been practicing. They must be wealthy men. Mahmud says they have paid fortunes to join the hunt. Firing a rifle from a moving truck, on rough ground, is easy, and so is hitting a target, even a moving one, if the gun is set to rapid fire. But I wonder what it will be like when the target has a will of its own and is capable of charging the truck. Will thirty rounds be enough to stop a stampede?

That is why bodyguards are needed, and one of the reasons why I am here.

23 September. Last night, when I prayed to the Buddha, I asked for the hunt to be successful, as well as praying for the health of my family. If the hunt fails, I will not get paid and my family will die.

Today the helicopter spotted a huge herd, more than a hundred animals strong. It tried to drive them in our direction, but the beasts fled to the east when they panicked.

I hope my prayers are soon answered more fully.

27 September. May Buddha forgive me. I have waded in blood until my *clothes stink of it. I lost count of the number of times I had to clean the blood off my chainsaw. The hacked-out tusks are piled high beside the tents.*

The guests were supposed to shoot only the bulls, but when the herd stampeded, fear took over our minds and we slaughtered them all—bulls, cows, even calves. I alone killed five bulls and a like number of cows, though I believe that through fortune I spared the little ones. I could claim to have been protecting the rich men, but the truth is, I was protecting myself.

I should be triumphant, for now my family will have food to last the coming winter.

I am not. I am ashamed. Yet, even in my shame, I check my gun for the morrow, making sure that its magazine is full. We shall hunt again.

5 October. Even though the trucks are half-empty, we are burying the tusks in pits. I know not why when everywhere we leave heaps of flesh and bone to paint the snowfields red.

Mahmud is busy with some instrument that I do not recognize. He tells me he is making a map.

At least the killing has stopped . . . but the reason is shameful. There are no longer any living mammoths within fifty miles of our camp.

Tomorrow, Mahmud says, we will go home. Our guests will take only memories, but we will take something more tangible. Though not in our trucks. Something to do with the natural ageing process—often I do not understand what Mahmud tells me.

I know I am not permitted to take any of the ivory, but I am unable to resist temptation. I have stolen a tusk, a small one, and hidden it beneath the baggage in one of the trucks. I have bribed the driver to look the other way when I recover it.

I have no fear that he will betray me. Like me, he needs the money.

My mind was in turmoil. It really was turning out to be the *damnedest* case. "Virtual reality?" I hazarded.

"It's a possibility," said Marcia. "But it's difficult to see what motive there would be for such a deception. Someone needed Tsong to *act* as a bodyguard, not just think he was one. So the hunt must have been real."

"Which means that the mammoths must have been real, too," I said.

"Yes."

Why did I always say the obvious when talking to Marcia? It made me look like an idiot. "Why did Tsong steal the tusk?" I said. "He must have known it would be dangerous."

"I imagine he was going to sell it, to help feed his family."

"But he *kept* it! Under the bed, wrapped in pink paper!"

"I don't think he planned to. According to some fragmentary records in Lasa, his family died while he was away, in the famine of '21. We don't have any dates for the deaths of his children—record keeping was a bit primitive then. But we know his wife, Tenzin, was the last to go, and she died on the 4th of October. Those facts are on the database."

One day before he came home. "So—he decided to keep it. As a souvenir? Something he could always sell if he was short of cash?"

"As a reminder of his shame, I think."

I found it necessary to break the silence. I was close to tears. I tried to focus. "So . . . somebody is cloning mammoths, maybe hidden away in the wilds of one of the minor republics. They drug Tsong and the other hunters so that they think the drive lasts only half an hour, but in reality it may have been days. . . . They bury the tusks for later reclamation—"

Marcia had raised one eyebrow.

"You're right," I said. "It makes no sense. Why not take the tusks with them in the trucks? And if there was some reason not to, why bother to bury the remaining tusks, when they'd left mammoth corpses piled in heaps? There'd be no point in concealing them, and in the freezing conditions the evidence would hang around for months, maybe years. Anyone finding the bones would soon spot the pits."

"That's one argument against the cloning theory," said Marcia. "There are about fifteen others."

I stared at her. "So—what *do* you think happened?"

"Officially, I have no idea."

"And unofficially?"

"Someone set up an expedition to hunt real mammoths, some place on Earth. They sold places in the hunt to rich men looking for kicks, with a profitable sideline for themselves in ivory. They killed hundreds, buried the ivory. For later collection, obviously. They probably came back for it without their guests, but if so, Tsong's diary doesn't mention it."

"The mammoths have to be clones," I said. "The carbon-dating says the tusks are modern."

"Not exactly," she said. "The carbon dating shows that very little time has passed since the mammoths that owned the tusks were killed."

I tossed this thought to and fro in my mind, puzzled.

"It's the same thing," I said. "Isn't it?"

"Take a look at this."

I was just leaving to meet with Salima when a package arrived. Although it was small, I opened it carefully—SCITES investigators, even ones that thought they were operating undercover, have been sent bombs before.

It wasn't a bomb. It was entirely harmless.

It scared the hell out of me.

Salima was waiting at her apartment. We both started to speak at the same moment. We each had something to tell the other, something we were excited about, something that couldn't be discussed in public.

We tossed a coin, and I went first.

I told her about Tsong's diary. Then I told her what Marcia had said, just before kicking me out of her office.

"They'd worked out where the hunt was, you see," I said. "There were mountains in the background of one of the photos, and although everything was covered in snow, the outlines were clear enough to pin the location down to within a few miles."

"So? Where?"

"Siberia," I said. "Some foothills to the northeast of the Khrebet Cherskogo."

"Okay, so there's a mammoth clone farm in Siberia."

I laughed, without humor. "Wrong on all counts, except mammoths and Siberia."

"Huh?"

"They're not clones. It's not a farm. And the present is the wrong tense."

I could see the penny drop. "You mean—"

"There was a glacier visible in one of the photos," I said. "Today, all that remains is a glacial valley. The terminal moraine is still there, and the time when the glacier reached that position can be dated from the rocks."

"And?"

"The photo was taken 11,000 years ago," I said. This was going to be difficult. Extraordinary claims require extraordinary evidence. I had very little, and all of it circumstantial.

I could see the scepticism on her face. "But that—"

"Means someone had a time machine," I finished for her. "Or a time-warp, a time-gate. Some way to access the past."

"Oh, come *on*, Mike! That's pretty far-fetched!" She gave me a hopeful look. "You *are* joking, aren't you?"

"Unfortunately not," I said miserably. "Look, it was Marcia's idea, not mine! Yes, it's crazy, but—it's the only thing that fits. I looked up time travel on the Net, and apparently it's possible in principle. But all known methods are hopelessly impractical."

"I'll bet. But you think—"

"I think some bright person found a practical one. Then I think one of the triads got wind of it, stole the gadget or put pressure on its inventor. Being of limited imagination, they decided to use the time machine to advance their latest scam."

"But you said Tsong's tusk dates as modern—oh."

"Precisely. *That fits too.* He brought it back with him through the time-gate. So its carbon-14 atoms only had a few years to decay. In its own time-frame, it *is* modern."

"Whereas by burying the main bulk of the tusks, in a known location—"

"They could leave them to age convincingly, and dig them up in the present day," I said. "No point in burying the rest, it would just need a bigger hole."

"But how could they know where to bury them, to be safe against accidental . . ."

Her voice trailed off. I looked expectantly at her, giving her time to finish the thought.

"They . . . they buried them in the place where they had already dug them up," she finished. "Which they knew would not be disturbed, because it hadn't been. Hell, it's logical, but the logic is crazy."

"That," I said, "is time travel."

"What are you going to do about this?" she asked.

"Nothing," I said. "No law has been broken, no endangered species has been threatened. They're in the clear, even if we could convince a judge and jury that someone has invented a time machine. It's not actually illegal to invent a time machine. Anyway, what about you?"

"Uh? Oh, the news I was burning to tell you? It's not as exciting as yours. The samples of mammoth arrived, the ones from the new deposits. A bit disappointing, really—just tissue samples. I'd been hoping for something bigger, maybe even a bone or two. Adequate for genetic profiling, but not much else."

"Still, that should give you any family relationships."

"Been there, done that. It looks like a dozen or so separate herds, all very closely related."

I grinned. "Then you've got evidence of more effective hunting."

"I know. But I wasn't expecting the mesolithic techniques to improve that much. Better edges to the flint spearheads, yes . . . but not mass slaughter, which is what it looks like."

I took her hand. "It's a puzzle, I can see that."

She gave my hand a quick squeeze. "It gets worse. Why were all the remains in the same place? It's not near a cliff or anything. Still, there may be more information. After the DNA analysis, I decided to try something else. Run some samples through a mass spectrometer, get their composition."

"What for?"

"Could be traces of environmental contaminants, clues to behavior . . . Hell, if I knew what I was going to find I wouldn't need to look for it, okay?"

"Sure, sure. So what did you find?"

"Nothing yet, the samples are still being analyzed. In fact"—she glanced at her wristband—"the results ought to be through by now. Give me a moment to call them up."

She went very quiet.

"Something wrong?"

"Uh—no, nothing wrong. Just not what I expected." I waited patiently. "Aside from the organics, there's some iron, plus tiny amounts of vanadium, tungsten, that kind of thing. The big puzzle is the uranium."

"*Uranium?*"

"Yes. Quite a lot of it. I wonder if there are any local sources of uranium ore?"

It was my turn to go quiet. When I managed to speak, I said "It's not ore, Salima. That's what an AK-83 assault rifle fires. Steel alloy bullets tipped with depleted uranium. It can kill from a mile away, packs a massive punch close up. Just right for killing elephants. Or mammoths."

"You can't mean—"

"Get your lab to do some isotope ratios, Salima. Call up the composition for the AK-83's ammunition—the heavy-duty stuff with uranium tips. I'm betting that if you age the ratios by 11,000 years, they'll be spot on."

"You *do* mean. Are you really—"

I sighed. "Salima, your mammoth graveyard is where Tsong's employers slaughtered mammoths, at the end of the Pleistocene. Not where they buried the tusks—those are long gone. Where they left the corpses. Tsong said it was cold, and he was from Tibet. In those latitudes it was still deep in an Ice Age. The corpses ended up in the permafrost where your Professor Zhao's Russian colleagues could dig them up." I paused. "Where exactly is this mammoth graveyard?"

"Near a small town called Yerekhtenya-Tala. It's in the wilds of Siberia, north of the Arctic Circle."

I brought up some maps on my wristband. "Not far from the Khrebet Cherskogo. That clinches it. You've made an earth-shattering archaeological discovery, Salima. It would be the jewel in the crown of your thesis.

"Except you can't use it. No one would ever believe you."

Her face was a picture. "No . . . they wouldn't . . . We've both discovered something amazing . . . and neither of us can ever breathe a word of it without being hauled away for psychiatric treatment and ideological retraining."

"Not even with those isotope ratios as evidence?"

"They'll say it's coincidence. Or modern contamination. Or bad technique."

"The photos? The diary?"

"Fakes. Fiction. *Anything* to avoid a time machine. You know what scientists are like. Paleontologists are worse. We know so little about the past, you see—" Her face paled. "Mike, what could a criminal gang do with a time machine, other than taking money off rich time-tourists and slaughtering mammoths?"

I'd been so keen to solve the puzzle that I hadn't thought about the implications. "Quite a bit, if they had the imagination," I said thoughtfully.

"They could go back and change the past, Mike."

I laughed. "They could," I said. "But it all happened 30 years ago. If they were going to cause time paradoxes, they'd have done so by now. Maybe the Time Police got onto them and took away their machine. Maybe it's not a machine, just a freak of nature linking modern Siberia to the Pleistocene. A time warp."

"Lots of maybes . . . Mike, if they *were* changing the future, right now—whatever that means—how would we know?"

"We wouldn't. It would just be a different 'we.' *This* 'we' is living in whatever world it all led to. Look, there's nothing we can do about it."

Salima still seemed worried. "At any rate," I said, trying to divert her away from deep philosophical questions that no one could possibly answer, "nothing criminal happened 30 years ago. Not technically. All they did was kill a few hundred mammoths, at a time when there must have been millions."

Salima went even paler.

"You okay?" She looked really ill.

"Yeah, sure . . . I've just . . . Mike, the time-tourists may have killed a few hundred on that occasion. But how many expeditions were there? Or *will there be*?"

We stared at each other, aghast.

"It's the timing, Mike. That photo was taken 11,000 years ago. Don't you see what that means?"

The irony was exquisite. "I was right, then," I said. "It *was* hunting that killed off the mammoths."

She made a face. "You were half right. It wasn't *ancient* humans."

"No, it wasn't. I concede. You realize that you've made one of the biggest paleontological discoveries ever? But . . . there's no way you can publish a word of it."

Salima made a visible effort to pull her thoughts together. "Publication be damned, Mike. This calls for action! The mammoths are dead and we can't change that. But we've got to do *something* to expose these people!"

I'd had a feeling this was coming. Salima is a fighter. "I agree. But it's going to be even harder than you think."

"Why?"

"I wasn't going to mention it in case you started worrying, but some kind person sent me a present this morning. An elephant carved from fossil mammoth ivory."

"That's nice. But who—"

"It's a warning," I said. "From the Chinese mafia. They know I'm onto them. They want me to lay off." I took a deep breath. "I'm beginning to think that Tsong didn't die of natural causes." She looked scared. So, I'm sure, did I. "But that's probably just me being paranoid," I added lamely.

She gripped my hand. "So *will* you lay off, Mike?"

I snorted. "Yes. For me, that elephant is the final proof. But no court of law would accept the connection. I'll drop the case."

"Very wise." She paused. Was that a look of disappointment? "That's not like you." She certainly *sounded* disappointed. She let go my hand. The blood pounded in my veins. Faint heart never won fair paleontologist. I took a deep breath.

"You're right, Salima. It's not. I'm going to nail those bastards if it kills me. But I don't intend to commit suicide just yet, so I'll make it *look* as though I've dropped the case. I'll need a lot more information before I can pin anything on them. Which triad, the name of its *shan chu*, what channels they use to sell the ivory—"

She protested. "But Mike, we've already agreed that no one would ever swallow anything as far-fetched as time travel!"

I nodded. "I'm not going to get them on time travel, Salima. Even if a court would believe me, hunting mammoths in the Pleistocene is perfectly legal." I tossed the package from hand to hand. "No, I'll get them the usual way SCITES deals with organized criminals."

"Which is?"

I sighed. "The oldest trick in the book. Tax evasion. As Al Capone discovered to his cost, you can't run an illegitimate operation and keep your paperwork in order. But it will take a lot of very cautious undercover work to accumulate the necessary evidence, and until then, I'll keep my head dow—"

She grabbed my ears and kissed me. "That's more like the Mike I knew! Uh—you still want me to move in?"

"The thought has never left my mind," I said, my voice muffled.

"I'll bet. Give me a month to sort out my rent, and then—no, scrub that, I'll move in tomorrow."

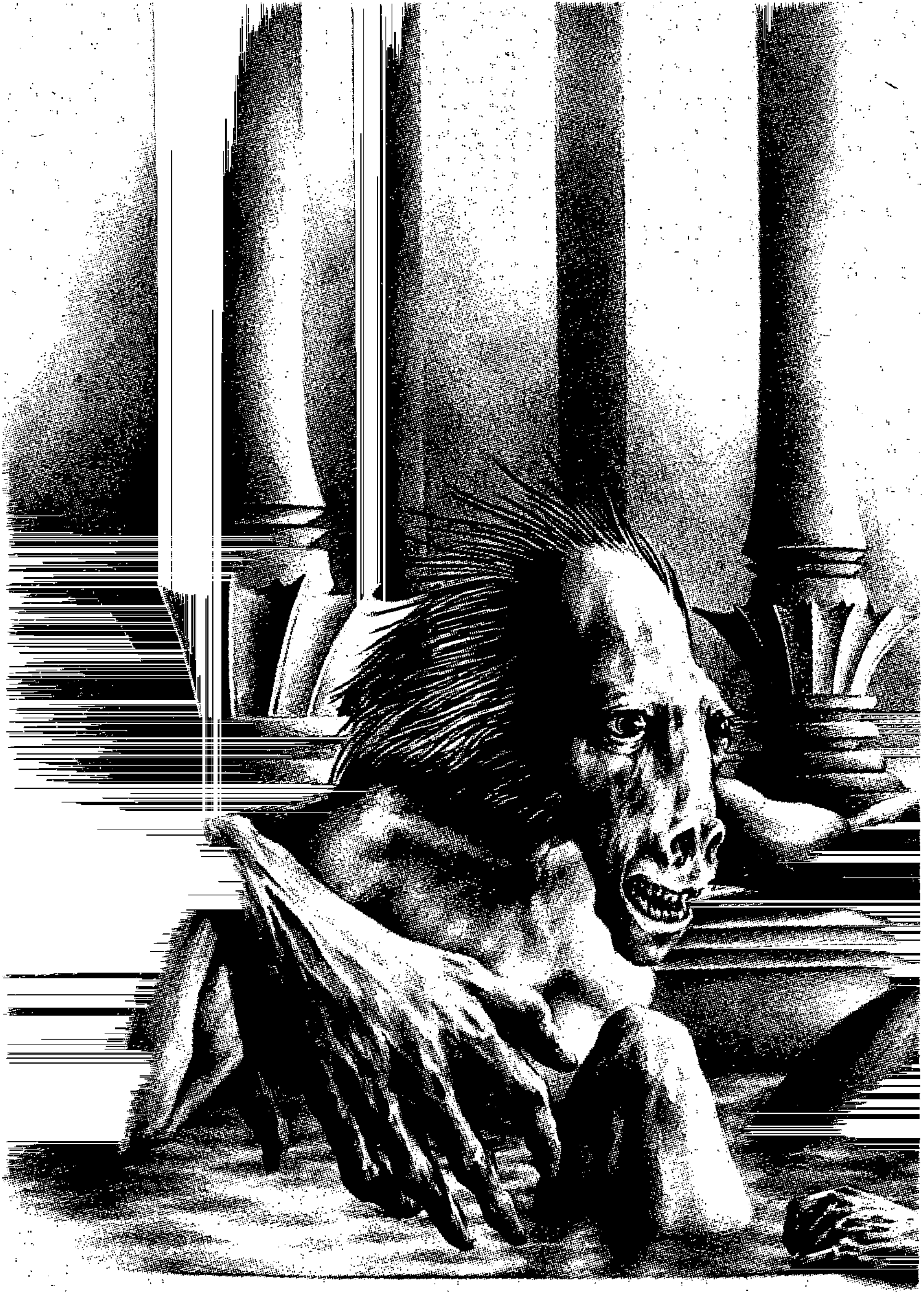
I gave her a quick squeeze, and tossed the package onto the couch. "I'll have to get this tested for fingerprints, but of course there won't be any. Strange to think that the ivory is from what is laughingly considered an approved source."

Through the plastic wrapping, I could see a slip of yellow paper.

I didn't need to look to know what was written on it. ■

If fifty million people say a foolish thing, it is still a foolish thing.

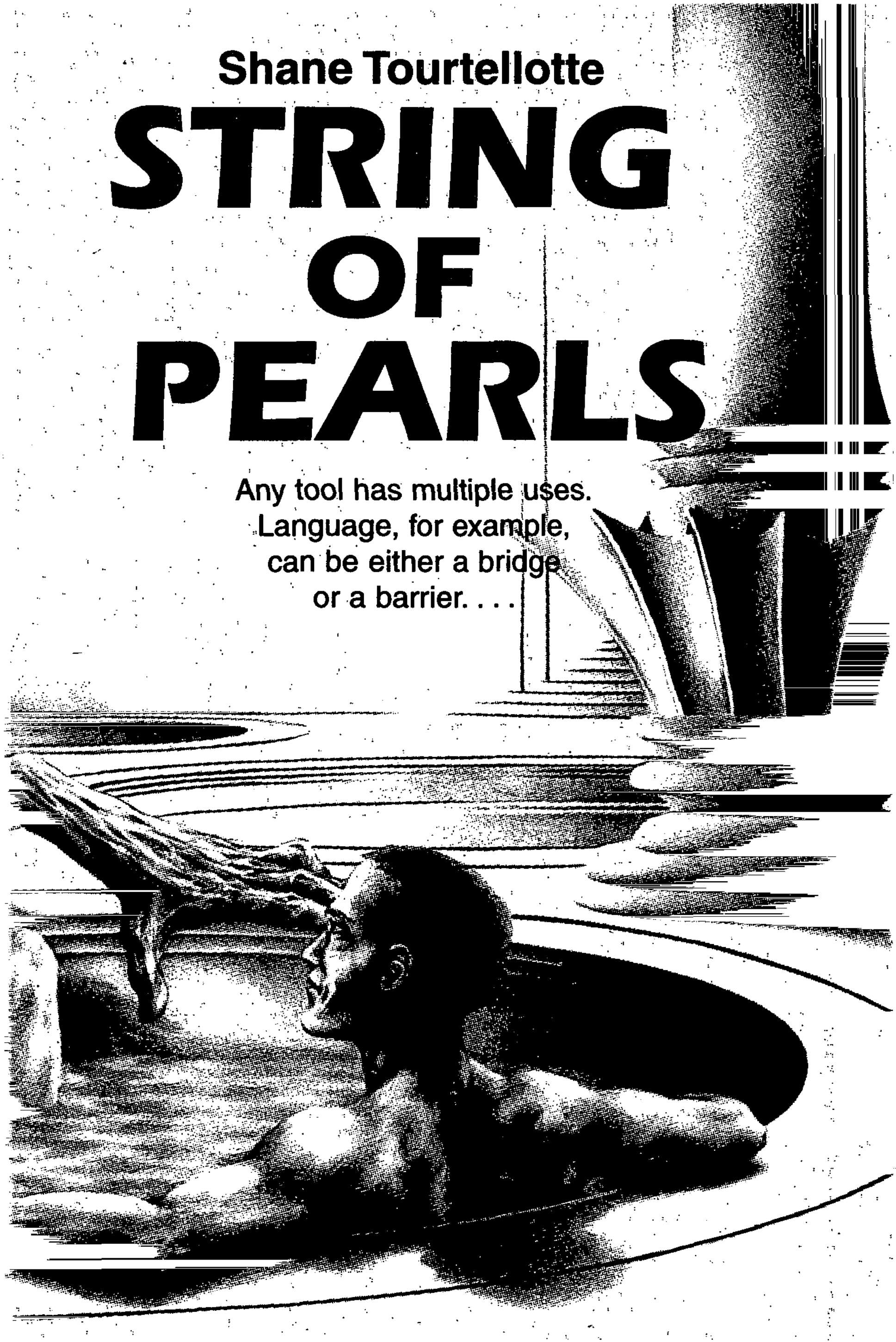
—Anatole France



Shane Tourtellotte

STRING OF PEARLS

Any tool has multiple uses.
Language, for example,
can be either a bridge
or a barrier. . . .



Illustrated by John Allemand

The doortone sounded, but Marcus Parrish didn't answer. He had set aside these hours, almost all his hours on the ship, for study in his cabin. He had to make the breakthrough, before planetfall if he could. The task allowed no time for casual socializing.

If his caller were just casual, he wouldn't have to worry. He settled back into the glossary before him, letting the deep white-noise hum of the FTL engines suffuse him, shutting everything else out.

The door sounded again, twice in succession. Marcus laid the tablet aside. So much for casual. "Is that you, Jun Hua?" he asked in his best New Mandarin.

"Did you expect someone else, Marc?" came the reply in English.

The familiarity with his name grated, but he ignored it. "Come in."

The door hissed up. Jun Hua slid his rotund frame inside, a move made harder by the large canvas bag he carried with him. "You've been avoiding me, Marc," he said, as he looked for a place to sit.

"I'm avoiding everyone." Marcus threw a couple of pillows to the other side of the low table where he sat. *Naha Uchusen* was a cramped ship, but it did try to provide comfort in its small spaces. "What brings you?"

Jun Hua folded himself down. "I wanted to give you a deeper briefing, about your sponsor on Obrith, and other things about the Kevhtre Union, including some pertinent social details."

"I've been studying the Kevh for years." He caught Jun's scowl. The aliens used "Kevhtre Union" as a corporate noun to describe both their race and their polity. They didn't seem to have a more succinct name for themselves. "Kevhtre" and "Kevh" were common abbreviations among humans, and humans only. Jun Hua was probably afraid he didn't know that. "If you've got info I haven't, I'm all ears."

Jun handed him a tablet slip. "These are some personal observations on Bunwadde, from embassy staff and Language Section officers. They have found him one of their most receptive private citizens."

"That helps when you do a lot of business with Earth," Marcus said, "even in the Kevhtre's particular style. Comes of speaking five human languages, I guess."

Jun nodded slowly. "That, and he is unusually tolerant of humans who try to speak his."

Marcus's cheeks burned. It was a failing all humans shared, but it still felt personal. He took the slip from its sleeve, and plugged it into his tablet. Reading it meant he didn't have to look at Jun Hua right now. "Must feel good for the language experts to find a Kevh who'll do as much as tolerate them."

That struck home. "We don't need reminders of our shortcomings. We get them every time we speak more than a few sentences of Vetra with a native speaker."

Sentences were the problem, of course, not words. The vocabulary was large but not that difficult: non-inflected, conjugation with tense-mark words, and just a few irregular plurals and possessives. But the syntax . . .

"And remember," Jun Hua continued, "you're in the same boat we are."

"I'm a businessman first," Marcus snapped, "not a linguist."

"But we have a common goal."

Marcus didn't reply. For them, it was an end. For him, it was a means, to break through in his business career, to break into the immense Kevhtre market. Or it had started so.

"Full immersion is often effective in learning languages," Jun said. "We would have done this earlier, if the Kevhtre Union government had not resisted."

That government knew the advantage it held. It banned its people from providing humans any language instruction, prescribing terrible punishments for the offense. Its computer networks were off-limits to humans, lest one dig up that information. There might have been attempts, but there had been no successes, and nobody had admitted a failure.

Marcus nodded. "It's easy to negotiate from strength. Do I want to know what we gave away this time?"

Jun stiffened. Another hit. "Luckily, there are some avenues that don't require negotiations."

He reached into his bag. Marcus perked up. Then his eyes widened. "What is that?"

Jun Hua laid the large box on the table. The top was dominated by a trio of triangles nested in a line, points up-down-up, white ideograms on black, orange, and black.

"*Tazpet nulb chomaken*," Marcus read. "Gems on a pendant-pin?"

"The English vernacular would be 'String of Pearls.' It's a very popular game on Obrith."

"Game?" He undid the clasps and opened the box. Inside was a round turntable with a raised grid, an equilateral triangle tiled with smaller triangles in several different colors. He counted sixteen triangles to a side.

Under the turntable was a drawstring bag. He spilled some of the contents onto the grid. They were the same triangular tiles as on the lid. They came in seven colors, like a human spectrum, but just that little bit off, like fruits not quite ripe. The red tiles faded toward orange; the yellow ones had a sickly greenish cast. The black was actually deep violet, if one looked closely.

He read a few of the ideograms, each with a tiny number below it. He flipped one tile, and found the same marks, the number now down at the point rather than at the base.

Marcus rolled the tile around in his hand. "I used to play a game like this. I was good, too."

Jun Hua chuckled to himself. "I know the game, but this one builds sentences instead of words, and has many other differences."

"Like, what spelling is to ours, syntax is to theirs." Marcus nodded, then knitted his brow. "But it isn't like they can use a dictionary as a judge, unless—" He found it just as Jun pointed: an on-off switch. The game had a built-in computer judge, and probably used chips in the tiles.

He still frowned. "So, I'm supposed to learn the language from this?"

"It's another part of the immersion. One more tool, and we have few enough. You should have plenty of opportunity to test yourself at it."

Marcus caught what hadn't yet been said. "Bunwadde plays this?"

Jun closed off any expression. "One of Earth's minor diplomats . . . learned this. It seems reasonable he would play you, if you were willing."

Marcus took that as a challenge. "Sure I'm willing." He looked at the board and the scattering of tiles. He pinched the tile he'd been manipulating between two fingers. "But forgive me if I'm not sure putting together rote sentences with—" He dropped the tile into its bag. "—a very limited vocabulary is better than hearing and speaking their language in context."

"Consider it part of the context, at least culturally. Besides, your stay with Bunwadde is all about doing several things at once. You'll be teaching yourself by hearing and reading and speaking, and playing; just as your work on Obrith is to learn the syntax, as well as to help Bunwadde build his—how did I see it described?—his pirate empire."

"Now, now, Jun. Not even I would call it that."

"Of course you wouldn't." Jun smiled. "Not in Kevhtre Union presence, certainly."

Marcus studied the game during spare hours in the week before planetfall. There were few of those. He had his other language studies, jumbled by the shift in sleeping patterns he was forcing to match Obrith's diurnal pattern. He almost never left his cabin.

He told himself it was helping his adjustment. It didn't help his learning. The great insight did not come. It felt like going into a battle unarmed.

The ship made sub-light transition during what was now to him the small hours of the morning. The shift in hum woke him, but he went back to sleep. It wasn't until mid-afternoon that *Naba's* shuttle touched down outside Ubhettid, Obrith's administrative seat. (Kevhtre Union translators rejected "capital" as too centralized.) Most of the passengers went in a group to the embassy, leaving Marcus alone in the terminal, standing outside the streams of Kevhtre walking by.

He was used to the people, but not to the numbers. They moved in streams of blue and silver, with robes in nearly every other color. A few looked his way. If he read their faces right, they were amused.

Soon, one was sure to come over, to say something to him. He'd be hoping for a good laugh. Marcus hoped he wouldn't give him one.

"Mister Parrish?"

To his relief, there was another human, standing by one of the public sinks and holding a sign. Within two minutes they were aboard the fellow's flitter, lifting into the sky and turning southeast.

The driver spent a moment making a call. "Bunwadde will meet us at the field," he said with a quick look at the back seat.

"Okay." Marcus had expected to go straight to his home, but Bunwadde was, in all senses, the boss.

They angled toward a landing field on the northern outskirts of Aghrelowa, not approaching the broad spread of the city or the river it abutted. Two buildings near the field had Bunwadde's company's name in story-tall ideograms. They drifted past those buildings, and settled onto a corner of the field.

Marcus's door popped open. "There he is," his driver said. "Good luck, sir."

He took the dismissiveness in stride, grabbing his bags and getting out of the flitter. He soon spotted the teardrop-shaped land car, parked off the edge of the landing field, with a figure standing beside it. Marcus walked over, through a buffeting of wind as the flitter took off a bit too early for comfort.

"Marcus Parrish!" the figure by the car said, easily audible over the flitter's departure.

Now Marcus was sure it was Bunwadde. The entrepreneur was big even for Kevhtre Union males, and had the voice to match. His two-belted robe was solid red, bold against his powder-blue complexion, and he wore a broad, shady hat. Gray bristles ran down his cheeks and neck, well-groomed. His prominent nose and the natural hunching forward of his head added to his bulldog appearance, like some old-time British Lord.

Marcus marched right up to him, getting an extra jolt of surprise at how tall two meters twenty really was close up. "A pleasure to finally meet you, Bunwadde Pesh Nuluk Mur-Aghrelowa. Thank you for inviting me to your home."

It was a canned greeting in Vetra, checked ahead of time for grammatical felicity. Using Bunwadde's full name on first meeting was properly polite. Bunwadde had done the same calling to him: Marcus's middle name embarrassed him, and it wasn't in official records.

"You compliment me by accepting my hospitality," Bunwadde said. "I hope you're not too fatigued by traveling."

"My trip here was comfortable," Marcus replied, using another prepared statement.

The driver had stepped out, and was putting Marcus's luggage into the car trunk. "Then let's not waste time with the last part of it," Bunwadde said. He opened a car door for Marcus, who stepped inside. Bunwadde himself got into the seat ahead of Marcus, doffing his hat, while the driver slipped back into the small steering compartment at the nose of the car.

Marcus nearly commented on the seating arrangement, but curbed his tongue. "I understand you're fluent in English," he said in English. "That will make communication easier still, for both of us."

Bunwadde tipped his head. "No doubt it will." He slipped back into Vetra. "But we should stay with my language. I'm sure you need the practice more than I do with English."

True as it was, it stung. "I understand," he said in Vetra. "We do need to discuss what specifically my work with you will entail."

"Naturally." Bunwadde reeled off several of the tasks, with scatterings of details. Marcus needed some of those details filled in, which meant asking unplanned questions. He was torn between deliberate slowness that would sound mentally dense, and the quick fluency of Bunwadde that he could not pretend to have.

He muddled on, doing his best. If Bunwadde found his syntax dim-witted or funny, he didn't make it obvious. If Marcus sensed certain hesitations before Bunwadde's answers, and a slower speech pattern to make himself clear to the human, maybe he was being paranoid.

Soon they were at Bunwadde's house, not far from the river that ran through Aghrelowa. It looked modest for someone as rich as he, but Marcus knew the two floors above ground surely topped a full floor below, and maybe more. "Very pretty," he said about what he could see.

Everyone got out. "Make sure the girls are there, Tropid," Bunwadde said, and the driver headed inside. Marcus retrieved his luggage, and started to follow. Bunwadde motioned him back with a huge, six-fingered hand. After a moment, he started ahead himself, with Marcus close behind.

He found a mist falling in the foyer, his host stretching his neck about as it drizzled onto him. Spying Marcus, Bunwadde shut off the mister. "Not a human indulgence, I forget. Come, let's meet everyone."

A Kevhtre woman stood waiting in the main hallway, with two children behind her. They inched toward Bunwadde as he came up, their eyes fixed on Marcus. "Here is our guest, Platp," he told his mate, "Marcus Parrish."

Marcus took this as his cue. "Greetings, Pesh Bunwadde Platp Mur-Kendi-Kelht. I am honored to join your household for this time." Again, his words were scripted.

Pesh—as with Bunwadde, Marcus would be using the more formal name—was closer to his height, but still nearly two meters. Her skin was more silvery than her mate's. Her robe was fuller, more like a dress, ample for the girls still hiding behind it.

Marcus bent at the knees, bringing himself to the children's level. "Good day, Pesh Milinor Mur-Aghrelowa. Good day, Pesh Movedhor Mur-Aghrelowa."

Milinor, the elder, finally looked him in the eye. "Good day," she said, abrupt to rudeness. Movedhor stayed shyly quiet.

"Forgive them," Pesh said as Marcus stood. "They've never met a human before. It's a long way from Earth. I hope the voyage was pleasant for you."

"My trip here was comfortable." He was repeating the canned statement, and he felt Bunwadde had to notice. He forged onward. "Interstellar ships have little space, but they find ways to compensate. Unless you really detest—"

Pesh's face went pinched for a brief moment. Milinor laughed, a stuttering, high-pitched bark. Movedhor began to imitate her sister.

"Stop that, children," Bunwadde said. They did, looking contrite.

"Well," Pesh said, covering her own lapse, "you won't lack for space or comfort here. In fact, you're welcome to join us in the conversation pool now. We'll get to know each other better."

"A good idea," Bunwadde said, "but Marcus needs to settle into his room first. Maybe he'll come down with us later."

"Yes, I will," Marcus said, daring no more.

He followed Bunwadde to a bedroom at the back of the house. It had a human-style bed, made of local materials, next to a standard Kevhtre sink. The bedspread bore sharp patterns of bright yellow, sea green, and purple, against the silvery sheen of the headboard and bedposts. The desk was also made for humans, in a good imitation of colonial style, though with a few knickknacks scattered on its surface that had to be Kevhtre, because Marcus couldn't see what they were otherwise. The walls bore several small paintings, bucolic landscapes mixed with jagged abstracts that defied framing.

Marcus took it in passively. "It's certainly roomier than I've had lately. Thank you very much." He lifted his bags onto the bed to start unpacking.

Bunwadde noticed the canvas bag immediately. "String of Pearls, I see. You play?" he asked with a skeptical tone.

Marcus was hoping Bunwadde would bring it up first. "I've been teaching myself." That made Bunwadde's bristles stand up. "It's a way to learn about part of your everyday culture, and to improve my language skills a bit. If you happen to play, I'll offer you a game any time." He kept unpacking throughout, as though this were nothing very important.

Bunwadde made a noise in his throat, then swallowed it. "I might enjoy that, Marcus. Thank you."

"It's my pleasure." He carried an armful of clothes to the dresser, this of Kevhtre design. It was made of native wood, suffused with blue stain, and its top reached his chin. He pulled out a drawer. "Might I ask a question? It's part professional, but part personal too."

"Please do."

Marcus cast his eyes around. "How well does this room mesh with Kevhtre Union aesthetic sensibilities?"

"It was furnished for your use," Bunwadde said, "so it's more important to ask how well it suits your taste."

"It . . . it doesn't. It's much too disparate, almost deliberately so. It . . . clashes," he finished, the last word in English.

"Exactly how I'd put it. I wondered how you would respond."

If Marcus had had bristles, they would have stiffened. "I don't think this room would seem right for any human."

"Some wouldn't care. Some wouldn't say anything about it. You aren't one of them. Marcus, I think we shall get along well."

So he had passed the test. "I'm sure we will."

Bunwadde walked toward the door. "I'll have Tropid help you rearrange the room right away—unless you'd like to join us in the conversation pool first."

"Thank you. I'll be down in a moment." He unzipped a pocket in one suitcase, and rummaged for his swimsuit.

Marcus got his office in one of Bunwadde's buildings the next day. It was on the top floor, unprestigious for Kevhtre but perfect for a human ego. Awaiting him there was a large inventory of Kevhtre items, and a lone female Kevhtre assistant.

One of his jobs for Bunwadde was to judge the likely profitability of Kevhtre arts and crafts on Earth, and the best markets for them. He found everything cataloged and cross-referenced. All he lacked was some obvious place to begin.

He handed the manifest to his assistant, picked up the nearest lot, and had her read off the notes for it. She stammered over it more than once. Was she afraid of him? Marcus could understand that from the children, but not her. Maybe Bunwadde had cowed her into an exaggerated awe of the human coming to work for him.

Handicrafts ran the gamut, but he saw the best prospects in the woodcarvings. The woods had colors and textures unknown on Earth, and carvings of Kevhtre and native animals added another layer of the exotic. They had serious broad-market appeal.

The jewelry might be another matter. The stones and metals were mostly things known on Earth; the premium for Obrithi gold or diamond or sapphire would be limited. The artwork on the metals and settings would help, but the only breakthroughs would be the biological stones, the local analogs of pearl and amber. The rest would be a niche market, though a high-end one.

Artworks were tricky. Stocks here were heavy on the jagged abstracts he remembered from the walls of his bedroom, though he found a set of electronic frames that produced kaleidoscopic fractal formations that mesmerized him. He assumed there'd be some sub-market on Earth for everything here.

He took his observations home that evening, and gave Bunwadde an oral synopsis. His boss seemed pleased, if tight-lipped, about it. "Might you want me to discuss all this with Pesh?" Marcus asked. His briefing notes mentioned that she worked for his company in distribution and sales.

"Of course not. This isn't her work."

"But . . . I had the impression—"

"She handles domestic sales, not off-planet ones." If he was going to say more, the sound of his daughters running downstairs from their tutoring session with Tropid stopped him. Business was over.

Marcus got back to inventory the next day. His assistant, Eshlarh, was definitely less overawed, and even a bit testy at times. Marcus minded very little. Work was mostly the same, and he had only a few new angles to discuss with Bunwadde that evening.

"No furniture?" Bunwadde asked. He was soaking in his private water room. Marcus had taken off his boots, rolled up his pants, and dipped his feet in the tub, to be polite.

"Most of it's too large for us humans, or creates awkward postures. It would be impractical, meaning sales would be for novelty alone. That could support sending a few items to create a scarce market with premium prices, but even that is questionable because for the same mass and bulk, you could ship other items that would bring much higher profits."

Bunwadde sat silently for a few moments, before giving an affirmative hum. "Very sensible, if I understand you correctly. Good work, Marcus."

The compliment felt good, almost uncomfortably so. "Thank you," he just said.

"You've earned a bit of relaxation." Bunwadde handed back the inventory list. "Would you like a game with me tonight?"

In the first press of work, he had forgotten about String of Pearls. "Very much, Bunwadde."

"Good. We'll make it right after dinner." He slid deep into the tub, until just his upturned snout and half his head showed above water.

Marcus wanted time to practice, but supper was imminent, and he ate with the family. Right afterward, Bunwadde asked him to bring his board upstairs. Odd that he didn't want to use his own board, but Marcus didn't mind.

Bunwadde was in his home office, shifting items off a sturdy table, when Marcus came up. "Bring over those chairs." Marcus got them, and met Bunwadde and the table in the middle of the room.

The furniture, of course, was sized and shaped for Bunwadde. Marcus felt like a child sitting there, and an uncomfortable one. "A practical example," he said, "regarding the furniture."

Bunwadde laughed. "You've made your point. Ready?"

He turned on the board. "*Tazpet nulh chomaken,*" it announced in a chipper voice already familiar to Marcus. "*Uredha lustodon?*"

"*Tra lustodon,*" Bunwadde answered. Two players.

"*Kuss. Groa vat lusto tragi.*"

The board had randomly chosen Bunwadde to play second. Smiling, Marcus reached into the bag, picking out tiles one by one. Soon he had eight arrayed in his dish, and he passed the bag to Bunwadde. As Bunwadde picked his tiles, Marcus hunched over the dish, and shuffled tiles around.

A minute later, he picked up six tiles. The first went at the apex; the others ran down the right-hand side of the triangular grid. The first and last tiles went on their own colors, doubling their values.

Marcus tapped the "*Lustep*" button. "Eighteen," said the board. The score flashed on a display between the grid and the bottom of the turntable.

"Good," Bunwadde said. He turned the board his way, as Marcus drew, then suppressed a frown. Too much violet-black in his dish. He'd have a tough time playing all those nouns without a conjunction: he had played his only one between vowels on his first turn.

Bunwadde put down five tiles, stringing up and right to the end of Marcus's first play, incorporating its last two tiles in the sentence. "Nineteen," said the board.

It continued this way for a couple turns: Marcus playing cautiously, but Bunwadde not pulling very far ahead. Bunwadde's third play gave Marcus an opening. Crossing it, he could get two high-value tiles on their colors. He laid it down, confident he was about to retake the lead, and hit "*Lustep.*"

And heard the rejection tune he had learned to hate all the way back on *Naha Uchusen*.

"Invalid sentence," the board said. "You lose your turn."

"What? I thought . . . What did I do wrong?"

"Sorry, not in the middle of a game." Bunwadde pointed at the board, and Marcus picked up his misplayed tiles. Bunwadde promptly laid down all of his.

"Forty-one," the board announced, "and a free turn."

Marcus could only sigh. Bunwadde drew fresh tiles, and played five of them in a prepositional phrase extending from the end of his previous play, for another big score.

That was a strategy Marcus hadn't thought of before. He tried it on a lateral play back up the board. It got rejected. Bunwadde then played his own prepositional phrase in front of that same sentence. It was good, naturally.

Marcus was never in the game after that. Nearly half his plays got razzed off the board. Much of that was self-inflicted, as he made desperation plays trying to catch up. One of those did work, drawing a compliment from Bunwadde that stung as badly as a taunt.

Bunwadde finished with a flourish, playing his last six tiles so a high-point adverb hit one of the four white spaces along the base of the board, tripling its value. "Thirty-one. Second player wins, 360 to 187."

At least it was over. "Congratulations," Marcus said.

"Thank you. I'm glad you could play."

Bunwadde started putting away the tiles, saying no more. No false or consoling compliments. No "Not bad for a beginner." Or "for a human."

Marcus resented not hearing something like that. He would have resented hearing it, too, but then he could have focused his resentment on Bunwadde, rather than himself.

A few minutes later, he was down in his room. Making sure the door was shut, Marcus unpacked the game again. He dialed the volume low, and turned on the board. He needed practice.

His ego healed, with the help of work. He finished off the inventory backlog at the office, and went downstairs to give Bunwadde the final report. Bunwadde promptly tasked him with drawing up a detailed sales strategy for the items the company would ship to Earth.

That devoured the rest of Marcus's day, and the evening, and much of the next day. He returned to Bunwadde's office with the plan in hand. Bunwadde looked it over, and thanked him without comment.

"That's all?" Marcus said. "I thought you'd want to review it with me."

"I may, in a few days. First I have to see what my other specialists, my Kevhtre Union specialists, have recommended. Don't worry, you'll have work to fill the time."

Bunwadde handed him a manifest. "We'll be getting this shipment from Earth five days from now. We have descriptive information on all the items, naturally, but I would like your own professional observations as well. Flesh out the descriptions wherever you have personal knowledge or interest. Tell me why particular items are worthwhile to own."

Marcus glanced up. "For Kevhtre Union or for humans?"

"For humans. Platp and I can handle the sales appeal to Kevhtre Union customers, but we want the added dimension of a human perspective."

They could have gotten that just as easily, or more, on Earth, but Marcus didn't say so. He scrolled through the manifest, with a growing unrest. "I see you're bringing in a lot of . . . intellectual property."

"The best kind. Added transport costs are almost nothing, and acquisition is often very inexpensive."

If a Kevhtre could look smug, Marcus had just seen it. "Inexpensive how? It's giving you and others a poisonous reputation on Earth." He saw Bunwadde's look change. "I'm sorry. I think I overstepped there."

Bunwadde waved a big hand. "No, it's plain you need to clear your nose on this. Speak freely."

Marcus needed a second to recover from Bunwadde's metaphor. "It's the opinion of a great many humans. They think Kevhtre Union traders are exploiting them, carrying off our culture for nothing. Video programs, music, literature—"

"But how can that be," Bunwadde said, "when Earth's own courts declared that the copyright protections you claim did not exist?"

Marcus couldn't deny that. There had been language in copyright law and contracts extending protection throughout the universe, or similar concepts. Courts had struck down such language as arbitrarily broad, not long before the Kevh made first contact. Attempts had been made to reinstate that language, now that the concept wasn't so theoretical. The courts were blocking those on the grounds that the language now amounted to deliberate discrimination against the Kevhtre Union.

"Obviously, the judges were wrong," Marcus said. "They lacked imagination. I don't see why Earth needs to suffer for their short-sightedness."

"If they were so short-sighted, how did they contrive to become such powerful arbiters?" Bunwadde stood. "I can appreciate your frustration, but humans have to live within the system they chose for themselves."

Marcus sighed. "Perhaps so, but that doesn't mean you must exploit that system to the limit." That stiffened Bunwadde's bristles. "I don't think I'm saying anything bizarre. As a businessman, surely you know the value of good will."

"I do. My exhibiting it, however, would not achieve what you want."

"Why not? You'd gain the gratitude of a lot of humans, who'd be much more willing—"

"Marcus Parrish, you are a smarter businessman than that. Maybe your trouble with our language is confusing you." Before Marcus could reply in anger, Bunwadde switched to English. "If I stopped obtaining exposed intellectual properties, it might gain me something in other areas, though probably not enough to compensate. But others would fill the space I had left. It only takes one, and you won't convince all my competitors to stop—any more than you'll convince me."

The next argument didn't come to Marcus. He didn't see one. Defeated, he looked back at the manifest. "I can only hope your customers on Obrith appreciate human writing."

"They like the video and audio productions more," Bunwadde said. "The writing is a smaller market, though there are some who enjoy human craft in that."

"Craft? We like to think of it as more creative than that."

"As art?" Bunwadde huffed through his nose. "There's no art in human writing, especially when the authors try to make art of it."

"Well, I don't—"

Bunwadde reached back with a double-jointed arm for a data pad. "I think I've kept you far too long. Get started on that manifest. I'll see you at home tonight."

Marcus had preliminary notes ready by evening, and expected Bunwadde to want to see his progress. He had other plans.

"Marcus plays String of Pearls," Bunwadde told his family at the supper table. "I thought we could all play a game of it with him tonight."

Milinor looked delighted, and Pesh quite agreeable. "Can someone teach me how to play?" Movedhor said.

"There's only room for four to play," Milinor told her. "You'll have to stay upstairs with Tropid."

"Mom!"

"Movedhor can help you play, Milinor," Pesh said firmly.

"And you can teach me, too," Movedhor added in the same tone. Milinor sulked.

By the time everyone was downstairs in the living room, Milinor was reconciled to the arrangement, and was explaining the game to her sister with only the occasional help of her father. Marcus sat opposite the children, while the adults set up the board.

"*Tazpet nulh chomaken. Uredha lustodon?*"

Bunwadde quietly told Milinor to answer. "*Gosho lustodon,*" she sang out.

"*Kuss. Groa vat lusto ibegi.*"

Milinor cheered as though she had just won the game. Movedhor cheered along with her. Milinor let her sister pick the tiles, then played four up the left-hand leg of the triangle for nine points. Pesh extended the play by three tiles, scoring nineteen.

That gave Marcus a good six-tile play, or so he hoped. It involved making a subsidiary three-word sentence, but its structure looked safe. He played it, and the board promptly razzed it off. Milinor and Movedhor laughed, their squeaky barks worse on Marcus's nerves than the board's rejection tune had been.

"Stop that!" said Pesh. "You won't be allowed to play if—"

"Let me handle this," Bunwadde said. "Girls, remember, our guest is human. Humans have trouble with our language. Now play nicely."

"Yes, Father," they said. Neither one apologized.

Bunwadde seemed satisfied, as he promptly turned to his play. Three tiles went down near the top, making five sentences in all three directions, every one good. "Thirty-five," said the board, and Marcus couldn't help being impressed.

Tropid walked in from the kitchen. "I heard your commotion," he said to the youngsters. "Are you being unruly?"

"They're fine, Tropid," Bunwadde said. "Thank you."

Tropid was about to withdraw, before spying the play Milinor was starting to make. "Remember what I taught you yesterday, Milinor?"

She stopped, got a serious look, and took back her tiles. Marcus opened his mouth, but felt Bunwadde's heavy hand on his arm. He might not have had the nerve to object to Tropid's meddling, but now he certainly didn't.

She finally laid down a two-tile extension. "If it's not good," she said to Marcus, "don't laugh."

"I would not laugh at you," he said, rather tartly.

Movedhor hooted softly. "What if he played *that*?" she stage-whispered to her sister. Milinor didn't reply, and hit "*Lustep*." The play was good, earning both their cheers.

Marcus's play turned cautious. The cramped, difficult board bequeathed by Bunwadde's play contributed early. Even after Bunwadde opened it up, at some cost to himself, Marcus went for acceptable plays, not high scores. It was his goal not to be laughed at again that game.

Once he lost that goal mid-game, his fallback was not to finish last to Milinor. He did not get much help.

"Father, what do I do with this?" Milinor turned her dish so he could see inside. Bunwadde leaned in and whispered his advice, then gave Marcus a look that dared him to protest. He didn't.

That play put Milinor in third, and she stayed there until the tile bag was empty. She made a play to go twenty ahead of Marcus, but he saw two ways to play his last four tiles. Both scored better than twenty, and no play by Pesh could possibly block them both.

He sighed—then gasped, as Pesh took all seven tiles out of her dish and laid them on the grid. He was too stunned to hear the board announce the final scores.

"One point, Platp," Bunwadde said. "Excellent play." Dimly, Marcus was aware that Pesh had just beaten her husband.

"And I beat Marcus, right?" Milinor chimed in.

"Listen again." Bunwadde got the board to repeat the score. Milinor shrieked with joy, and began capering around the room, Movedhor right behind her. Bunwadde joined in her celebration, picking her up and doing his own heavy-footed dance.

Marcus just sat, watching, listening, burning.

Work was not a very good salve that time, even though there was lots of it. Bunwadde's incoming shipment was large, and notations for all of them took time, even where Marcus's knowledge was thin. Neither was he in a mood to confess ignorance, on anything.

He delivered a preliminary list to Bunwadde late that day. "I should have the full descriptions done by the end of tomorrow," he said, "but that's a good start."

Bunwadde's head made a slight, vaguely affirmative motion. "It is satisfactory for now. Platp and I can work on this during restday."

Marcus hadn't noted the calendar. "Will I be coming in to work tomorrow, sir?"

"I don't see the point. Almost nobody will be here."

"I see. Still, I should bring the files home. I'll be able to finish up there, pretty easily."

"Yes. Good."

Marcus didn't like the growing sense of detachment. "We might even have time for another game tomorrow. I hope it can be just us. I find I learn—"

"I'm sorry, Marcus," Bunwadde said, standing up, "but I'm not interested in any more games with you."

Marcus felt himself shrivel. "I'm sorry if it was presumptuous of me to ask that way."

"It was, but that is not why I refused. I would not enjoy another game." His mouth took on a downward curl. "I do not find it a challenge."

It was like being punched in the gut, slowly. Marcus tipped his head. "I understand, sir," he said, and made for the door, carrying all the dignity he could.

"However," Bunwadde said, catching him at the threshold, "I don't mean to frustrate your hobby. I will see to it that you get to play."

Milinor cupped her hand over the raised edge of her tile dish, and lowered her head. "Don't peek," she said, with a crafty look.

Marcus didn't protest his innocence, but leaned back in his chair to show he wasn't looking over her hand. It gave him a twinge in his knees. The furniture in the upstairs study room was scaled for the children. That made it a little better for humans than the adult furnishings, but it was still built wrong for him.

While Marcus rubbed a sore leg, Milinor picked up five tiles and arranged them on the board. She then sat, looking at them, frowning. When Tropid came in to collect some books, she called out to him, "Is this right?"

Tropid looked at the board, then briefly at Marcus. "It would not be fair for me to say, Milinor. This is your game, not mine."

"But you told me the last time!"

Tropid grew stern. "Remember, Milinor, your father said you could have these games with Marcus if you behaved yourself."

Pouting, Milinor turned away from Tropid and pressed "*Lustep*." The play was good, lifting her spirits and extending her lead to twenty-nine.

Marcus looked his dish over again. He still didn't have anything very promising, except one play through Milinor's last sentence that would use all his tiles, in the unlikely event that the computer accepted it.

It was late in the game. Without this play, he would probably lose. If he made it, and it stayed, he was almost sure to win after all. If it got kicked off, he was certain to lose, and he was just as sure how Milinor would react, whatever Tropid might think.

Bunwadde would like it if he lost. Indeed, he expected it. He held Marcus's playing in contempt, and Marcus was growing sure that Bunwadde held him in contempt.

He and Pesh were downstairs now, combing through his product descriptions. Marcus was useful to him, praiseworthy as far as he furthered Bunwadde's business, but nothing more. How could he be worth more? He was only human.

Marcus stopped himself. Was that injured pride talking? Was he taking all the little wounds he had borne and building them into a grand edifice of paranoia and self-pity?

The Kevhtre had humans overawed, and he was starting to fall into that mindset, the helpless victim. Even if Bunwadde were deliberately belittling him, this was just how he would want Marcus to feel. Well, he wouldn't play that role. He wouldn't be helpless, or afraid.

He scooped up all his tiles and laid them down the board, all the way to the bottom row. Milinor moaned, but he eschewed anything that could even seem like gloating, and hit the button.

"Invalid sentence. You lose your turn."

Milinor did not eschew the gloating.

"Welcome, Marc," Jun Hua said behind the desk in his office. "Please have a seat. How was your trip in?"

"Okay," Marcus lied. He had been nauseated the whole way from Aghrelowa to the Terran Embassy in Ubhettid, not from airsickness, but from aversion to the debriefing to come.

"Glad to hear it. It was good of Bunwadde to let you off for the morning."

"They're unloading a cargo ship at the landing field. Bunwadde's supervising that, so he doesn't need his shill for a few hours."

Jun Hua raised his eyebrows. "Shill? What's the matter? And do take a seat."

Marcus paced over to the window, which mostly showed the building next door. "He had me writing descriptions of his incoming inventory. Turns out I was writing the first draft of a script: my own. He means me to be the presenter for those items in his network catalog."

"Then Bunwadde finds you useful," Jun Hua said, almost smiling. "Isn't that good?"

"He finds me convenient. I'm a human face, and voice, to lend an air of exotic authenticity to his wares. My actual expertise is secondary, if how little of my report made the script is any indication."

"But certainly you—Marc, either sit down or stop pacing so at least I can go stand next to you." Still fuming, Marcus dropped himself into the chair, swiveling it so he looked at the side wall, not Jun. "You understood Bunwadde was hiring you to help his business from the start."

"I did, but I didn't think he'd—" He sagged into the chair, not even noticing that it was made for humans, and didn't torment his back or legs. "I thought I would be an advisor, not a mouthpiece."

"Does he have you speaking Vetra or English?"

"Oh, Vetra. He trusts me to do that from a script."

"Ah. Can I infer from that that Bunwadde trusts you less to speak Vetra in other circumstances?"

"Infer what you will," Marcus grumbled.

"I shouldn't have to," Jun Hua said. "You're here to inform me fully about your progress. If we don't get that information, I can have the embassy invalidate your visa. It wouldn't help your career back on Earth to have an expulsion from Obrith on your record."

"In some quarters it might," Marcus answered, but his heart wasn't in the retort, and Jun Hua could tell.

"Answer my question, Marc. Are you making progress in mastering Vetra syntax?"

Marcus seemed to examine the floor. "No. None that I've noticed."

"Is String of Pearls not helping your studies?"

He tried to hide a wince. "It's not giving me any special insights. I'm working on it. I've gotten to play several games."

"Against Bunwadde?" Jun Hua asked. "And did you win?"

"Two against Bunwadde. And I didn't beat him." He didn't mention his games with Milinor. He had actually won his first one yesterday, by all of two points. His ego wasn't so far gone that he would try to brag about that.

"Did you keep the games respectable?"

Marcus finally looked at Jun Hua, who didn't bother trying to wipe the faint, supercilious smile from his face. "Are you enjoying this, Jun?"

The smile opened a little, like a flower to sun. "The Language Section has endured a lot of scorn from humans—especially some business people—for not solving Vetra syntax. When such people learn for themselves the intractability of the matter . . . well, it's only human to feel a little vindicated."

Marcus's nausea came back in full force. "Not very professional of you, is it?"

"Better a little professional than completely amateur." Jun Hua picked up a tablet. "So tell me about these games, Marc. Each one, please."

Marcus thought for a moment whether his career could actually be advanced by getting tossed off the planet. It might, if he could somehow repay the travel costs to and from Obrith that the Language Section, for now, was carrying for him. He didn't doubt they would soak him with that.

"I'm waiting."

No matter how he ran the numbers, he couldn't make them add up. Willing his stomach to behave, Marcus started to recap his games.

Marcus didn't eat much at dinner that night. He did take double helpings of water, to soothe a mouth and throat strained by several hours of recitations for the catalog. Declining Milinor's offer of a game, he took to his room early.

He began his nightly language studies, but could scarcely concentrate on his texts. There seemed no point to trying. The gulf was too wide. Finally he pushed the tablets aside, and pulled out his String of Pearls set.

With the game's volume so low even he could barely hear it, Marcus started experimenting. He would lay out a sentence, see if it was good, then reset the game and try it in a different arrangement. He marked down the versions that were syntactically proper on a tablet, and moved on to another sentence, and another.

He searched for patterns in the valid sentences, but they remained as elusive as ever. Sentence structures that worked often became invalid when he substituted a new subject or verb, or even a preposition one time. He could not see the rules.

Marcus kept testing, despite seeing the hopelessness. One could learn a language's vocabulary by rote, but a variable grammar? He told himself that a sub-vocabulary of one hundred fourteen, all the words appearing on the tiles, was a place to start.

He kept at it past midnight, and didn't get nearly enough sleep. It was an effort to give his catalog readings the same energy they had had the previous day, but he felt he was succeeding.

Eshlarh, his assistant, grew edgy fast. "Take a rest, Marcus," she said. "I will return soon." She left the studio, her big slapping feet putting Marcus in mind of an agitated duck.

Marcus stewed. Throughout the recordings, she had been acting like his boss, not vice versa. This was just one more order he resented.

Eshlarh returned quickly. "Let's do a few more, fast," she said, advancing the prompter text. "Bunwadde will be here soon. He'll have some encouragement for you."

He didn't like how that sounded. He kept reciting, though with his first flubbed line of the day, until Bunwadde arrived. To Marcus's surprise, Bunwadde was carrying a small urn with insulated handles, and a cup perched on the top.

"Maybe this will help," Bunwadde said, setting things down on the shelf of a sink fixture. "It was part of the shipment bound for the Terran Embassy, but I have diverted a modest amount." He waved Marcus over. "Have some."

Marcus came over, wondering if he recognized the smell. He put the cup under the tap, turned the valve, and soon had no more doubt. "Coffee?"

"Technically a luxury," Bunwadde said, "but I have heard some Embassy humans speak of it as a necessity. I suppose they are right, by what Eshlarh tells me. Take whatever you need."

"Thank you," Marcus said, even as he felt the patronizing sting, again. Apparently sugar and cream weren't part of the necessity, but the coffee wasn't bad without them. He drank a cup for medicinal effect, and got back to reciting. That dose, and a second a few hours later, had him back to performing at par, or enough so that Eshlarh was much calmer the rest of the day.

He got through his performance, and had a bit more appetite at dinner that evening. He did not, though, have increased confidence in his game-playing. "I'm sorry, Milinor, not tonight," he said when she asked again for a game. "I'm tired from work today."

"But I want another game," Milinor complained. "This is just because you won the last game, and you don't want to lose again."

"Milinor!" Pesh said.

"That's not true," Marcus lied reflexively. It went unchallenged, as Milinor's parents, Pesh in the lead, took away her game privileges for the night. She apologized sullenly to Marcus, sounding awfully like any seven-year-old.

Marcus soon retired to his room, and went straight to the desk and the game. Tonight, he was calculating the color frequencies of the tiles and the board spaces. Which tiles could get premiums for landing on their color most often?

It was the nouns, of course, but compared to their frequency in tile distribution, there was a paucity of violet-black spaces. Worse, almost all the nouns were low-scoring, so one didn't gain much. The ratio was better for everything else. Conjunctions were best, with verbs and tense-marks not far behind.

From these statistics, he could gain a better idea of what tiles it would pay to hoard, what tiles he should play on matching spaces when he could, and what tiles he shouldn't bother trying to match. It was a first step in game analysis: if he couldn't win on strength of grammar, maybe he could win on strategy.

Maybe it would be enough that Milinor would grow sick of losing instead of him. Maybe it would be enough that he could compete with Bunwadde. Then he could tell *that* to Jun Hua.

But it wouldn't hurt to know more. He counted up how many of the conjunctions were group conjunctions, useful for noun-heavy dishes. He toted up the various tenses of the tense-marks, theorizing how they could relate to one another in a compound sentence. He studied the pattern of the board, thinking of how he could set himself up on one play to hit premiums with leftover tiles on his next.

He didn't hear the footsteps until too late. He could do no more than set the board atop its box lying on the floor before his door swung open.

"You're still awake," Bunwadde observed.

"Yes," Marcus said. "I'm still having trouble sleeping." He walked over to his bed, hoping to draw Bunwadde's eyes with him.

"I hope it is not the coffee. I didn't think its effects lasted so long." His eyes moved. "Were you playing?"

"No." That was true enough. "I was just looking at it, whiling away time, trying to lull myself to sleep." Bunwadde's cool gaze pressed in on him. "Trying to understand it better, too, perhaps."

"Good. I'm glad you still have an interest in the game. Milinor will be, too. Now do rest, even if you cannot sleep. We need to finish the catalog tomorrow."

"Yes, Bunwadde," Marcus said, sighing.

"That's a pretty play."

Marcus didn't reply to Milinor. He didn't believe her. It was a mediocre play, a safe play that wouldn't lose him a turn, but wouldn't get him the lead or set him up to take it. Even if she meant it as a genuine compliment—he didn't trust much these days—it felt like mockery.

Milinor made her play, with a quick look over to Tropid. Marcus glanced at him too, but the servant showed no expression. Marcus turned back to his dish, and thought over his options.

He had a six-tile play that would score fairly well, but not vault him ahead. There was a shorter, lower-scoring play on the other side of the board, though, that would let him keep a conjunction with two spaces of its color in easy reach. It would mean keeping two tense-marks, which could be awkward, but with the right draw, he could play them combined with the conjunction and make a big score.

The board chimed. "You must play within thirty-two *kaphon*."

"See, you're taking too long!" Milinor said.

"Sorry." He made the shorter play, and drew new tiles. Before he could look at them, Milinor made her play, covering one of the spots for his conjunction with a mere noun.

Marcus looked over his new tiles, and frowned. Two more tense-marks. He might still reach the conjunction premium, but not without leaving his dish clogged with tense-marks. He gave it up, and found a place higher up the board where he could hook onto an existing verb, playing off his conjunction to help clean up his holdings. The score got him a little closer, but not much.

He tried more set-up plays, but by the time one worked for him, he had sacrificed more points than he gained with his lone success. By the endgame, he needed an eight-tile extra-turn play to have a chance, but the branching sentences had cut off all the empty areas. He made one of his familiar desperation plays, and got the familiar rejection tune from the board.

"I won, Tropid!" Milinor shouted after the board recited the score.

"Yes, you did; and you made no incorrect plays. Good work."

Marcus packed up the board quietly, but not fast enough. "We're going to play tomorrow, right?" Milinor said.

"If your parents and Tropid let you," Marcus said, "and if I don't have to work too long."

Milinor hooted at this. Marcus didn't know whether it was his grammar again, or whether she found his work patterns so risible.

He left the game in his bedroom, and went downstairs to the water rooms. He gave himself a quick shower, part of his daily routine. Before dressing again, though, he departed from habit, and went over to one of the lounging pools. He put in one foot, and found the water bracingly cool. He laid aside his towel, and stepped in. Aghrelowa's heavy heat never seemed to lift, and this was a refreshing departure.

He leaned back, luxuriating. Time seemed to fade away, leaving just himself and his thoughts. For a few minutes, those thoughts didn't include the frustrations of the day, and every day. They did creep back, stealthily, reclaiming their accustomed place.

Marcus lowered himself a few more inches. Only briefly did he imagine drowning himself there. "Very impolite, I'm sure," he said to himself. "Upset the whole household." He didn't feel that badly about *all* of them not to care.

Someone came thudding down the stairs. Marcus let his solitude go philosophically: this room was too heavily trafficked for it to last. He saw it was Tropid, a mild surprise. "Good evening," he said politely. Tropid had always been correct toward him, no more and no less.

"Good evening, Marcus," Tropid said. "It's good to see you're having a cool soak. You were long enough in taking advantage—or are humans less sensitive to heat than I've heard?"

Marcus had never heard such garrulity from Tropid. "I can't say what you've heard," he replied, "but the water feels very good. And how do you know I haven't used this pool?"

"I have to keep track of everything in the household." Tropid slipped off his sandals and shed his robe, leaving him down to a broad strip of cloth covering him from stomach to mid-thigh. He thought better of removing it, and stepped into Marcus's pool with it on. Kevhtre shared pools without a thought, and Marcus didn't mind.

Tropid made a guttural "Grrraahh" sound as he lowered himself into the water. He sat quietly, head back, for a moment, before looking at Marcus. "I hope you do not hate Milinor."

"Hate her? I . . ."

"She has a kind side to her, but she is competitive. That has served her parents well, and they are teaching her—and having me teach her—to be the same."

"I . . . understand, Tropid. I can't blame anyone for that."

"And she is very bright, very perceptive."

Marcus chuckled. "That's something of a comfort."

Tropid gave him a long look. "I think I understand *that*, Marcus. Your position here is awkward. Sometimes, it is more awkward than it needs to be."

Marcus absorbed that slowly. "I cannot really complain. I wasn't drafted."

Tropid's features bunched up. "What was that?"

Maybe that idiom didn't translate well.

"I wasn't forced to come to Obrith. Whatever happens here, I came to it with my eyes open."

Tropid droned, deep in his chest. "Open eyes do not see everything ahead."

Tropid was surprising Marcus every minute. He was presenting overtures of sympathy, of friendship—or was it more?

The Language Section reportedly had been feeling around for a Kevhtre Union citizen to defy the government and explain the language to them, to fill in what humans were missing. They had made no progress, and rumors about the cost of their failures had been disturbing. Had Marcus stumbled onto what they had missed?

He moved cautiously. "Naturally, it is frustrating to understand something when others use it, but not to understand how to use it oneself."

"Yes, it must be painful," Tropid said, "but it is something you must confront yourself."

"I have tried. I also think I've gone as far as I can by myself."

Tropid shifted, sending little waves across the pool. "I already have a job as a tutor, Marcus Parrish. I don't think you should ask me to do more."

Marcus said nothing. There was no more to say. He didn't pretend Tropid's answer carried any ambiguity. After a decent interval, he reached for the towel at the edge of the pool. "Thank you for the company, Tropid."

Marcus stood by the window in his bedroom, watching dusk fade to night, thinking. Standing was about as comfortable as sitting in his Kevh-style chair, and would be kinder to his legs in the morning. String of Pearls was packed up and under his bed.

He wished he could keep the game under there forever. It had been an incubus, promising him language insight, and giving him worse than nothing. It had led him astray, and much of that was his doing. He had come to treat the game as its own end, not as a learning tool. That had let Bunwadde make it his own tool, to keep Marcus humiliated, to keep humans in their place. Just one tool for him, but a particularly irksome one.

At least the mortification of his shilling stint was finished—until the next shipment from Earth arrived. Bunwadde would find more work for him, of course, but he would have to look hard to find something as embarrassing to Marcus.

He quickly regretted thinking that. Bunwadde would manage, somehow. Marcus doused the lights and slipped into bed, hoping not to carry that thought into sleep.

As usual, rest was elusive. His everyday failures were frequent nighttime companions. His latest loss was with him tonight, that and Milinor's "pretty play" comment that clung stubbornly under his skin.

He could envision the words now, in the darkness. The play was a stair-step parallel, one short horizontal sentence played under another, overlapping by two tiles, one base and one vertex. The play made two additional short sentences on the diagonals.

It wasn't special. That kind of play happened constantly, as much as a dozen times a game. Milinor made such plays herself, without such a compliment. If he had overlapped four or five tiles, difficult but doable if verbs were in the right places, that might really be pretty.

But Milinor was young, and no student of the game. When she said a play was pretty, she didn't mean it was tactically elegant, she meant it looked pretty. Maybe she was babbling childishly, but Marcus didn't think so. Tropid said she was bright and perceptive, and Marcus believed him.

What was there, in that nest of curves, bars, slashes, and dots? He tried to think, but concentration was ebbing.

The ideograms began swimming in his head. Soon they were undulating like the surface of a restless sea.

He gasped. Had he drifted off? Had he been half-asleep the whole time? He was wide-awake now.

He turned on a light, found a tablet, and wrote out the ideograms, each of the four sentences on separate lines. He fixed on the second one. It was a bramble, but within it he could see the sketchy, gentle sweep of a sine curve, falling, rising, and falling again. The third sentence was the same.

The other two, Milinor's sentence and his, didn't have the sine curve, but Marcus knew now that there was some pattern in them. In those patterns would be the explanation of why one arrangement of words made a sentence to Kevhtre eyes and ears, and another did not.

He started making notes on his tablet. He didn't mean to stay up all night, but he was going to leave himself enough information so his insight wouldn't fade like dreams.

He was going to be tired at work again tomorrow. This time, it would be for the right reason.

Marcus heard Bunwadde walk into his office. "How is your work going?" the boss asked.

"It's going well. I'm writing up the reports on your new export items. You can have the first group now, if you like."

He knew how Bunwadde would answer, and was putting it on a tablet before he asked for it. Marcus had been able to go further in-depth on marketing strengths and weaknesses for this group, partly because it was smaller, partly because he had requested as much informational material on the items as he could get. Those materials had helped a great deal more with his other work.

"You really have these sculpture replicas rated so low?" Bunwadde asked. "I understand about the name, but might that not be a selling point with some humans?"

The sculpture's title in Vetra sounded very like an English vulgarity. Marcus wondered if Bunwadde would notice how red he was turning. "It could be, except that the thing it means in English looks . . . similar." Bunwadde said nothing, but studied the tablet, turning it this way and that for a different look.

Marcus's studies of Vetra had been moving fast, but outwardly he was playing it slow. Jun Hua knew nothing. Marcus's ambiguous reports to the Language Section, hinting at some possible progress, would sound like forlorn masking of continued failure. He would reveal himself in his own time.

"Good work on this," Bunwadde said. "Indeed, I am gratified at how you've settled in during the last twenty days. You had some difficulties before that, but you have definitely found your place here."

Marcus went through modest motions. "Thank you, Bunwadde."

"Of course, Milinor has been complaining about you."

"She has?"

"Yes. She tells me you've been beating her at String of Pearls lately."

His restraint had fallen to his competitive spirit here. Last night was his fourth win straight against Milinor. "I have, sir, finally."

"It was a while in coming. Do you feel up to playing me again?"

Marcus heard how he turned it around, as if Marcus had been the one to refuse more games, avoiding Bunwadde's beatings. He fought the urge to leap on the offer. "Well, will it be a family game, or just us?"

"Just us, I think."

"Well . . . all right, I think I'm ready."

"I'm glad to hear it," Bunwadde said with a slight grin. He had heard Marcus's garbled syntax in that last sentence, as Marcus had intended. "Are you ready for a meal break?"

"Not yet, thank you. I want to get

through some more of these reports." Bunwadde let him do that, and Marcus buckled down, not to writing, but to reading: reading more of those informational materials, delving into the patterns of ordinary words that were more clear to him each day.

Dinner was excellent. Either Marcus was growing more used to Kevhtre cuisine, or Tropid was shading the fare toward a human palate. He would remember to thank Tropid either way.

Once they were done, Bunwadde went upstairs to get the board. "Not this time," he said when Marcus started to follow. "Go down to the living room. We'll play there."

He wanted spectators for this, of course. That suited Marcus. He went downstairs without complaint, and sat himself at the big table. Milinor and Movedhor pulled over chairs, and stationed themselves opposite him.

"We're going to help Dad win," Movedhor said.

"Really?" Marcus said. "And who will help me win?"

"You aren't going to win," Milinor declared. Marcus had the decency to squirm in his seat, though only to relieve the usual cramping.

Bunwadde arrived with the game, and sat to one side. Marcus obligingly shifted his place to sit opposite Bunwadde. Pesh came down and stood with her daughters as Bunwadde set up the game.

They started, and the board picked Bunwadde to play first. He scarcely looked at his tiles before he laid six of them down the right-hand leg of the triangle, hitting three matching colors. "Twenty-three," the game announced.

Such a strong opening would have flustered the old Marcus. Now, he just studied his dish, and the board. The girls began to fidget. Milinor tried to peek at his tiles, but he ignored her, and Pesh told her to stand with her father instead.

Finally, Marcus picked up five tiles in one hand, and laid them up and right, joining with the third and fourth words in Bunwadde's play. Marcus looked at it, and nodded. Then he added the last three tiles to his sentence and hit "*Lustep*" without hesitation.

"Twenty-eight, and a free turn."

He saw Bunwadde's surprise, and heard that of the children. He enjoyed them both.

His free play ended up small, to use up awkward tiles, but it set him up for a fine score the next turn, consolidating his lead. Bunwadde made good plays his next few turns, which didn't rattle Marcus now. He didn't have to take blind chances. He could see the plays, really see them. He could see how the pair of parallel bars in one noun meshed with the bar in a following verb, or clashed with the backslash in an adjective.

It wasn't perfect. He didn't grasp all the rules yet. But there were moments when a grouping of words looked right, and only the next moment did he see why.

A few times, he even thought he had heard some likeness of the patterns in spoken words. It was nothing as easy as direct equivalence, or analysts would have noticed it before. He had to work on that—but first things first.

He made a middling play, setting up a line to an orange-red space. He had a big adverb to play there, and the tiles to reach it. Even if it got blocked, there was a second such space across the board he might hit.

Bunwadde did block it. Marcus had a possible play at the second triangle, but saw that Bunwadde's play had opened the way to a third. He got to it, with all four tiles going on their own colors. "Thirty-one," chirped the board.

Bunwadde said something Marcus couldn't hear. The children had drifted toward him, and started pointing at his tiles and making suggestions. Pesh hushed them, before giving Marcus a strange, nervous look.

Marcus saw something he wasn't used to: Bunwadde making risky moves. Not grammatically risky, but strategically, trying to open the board for eight-tile plays, playing short sentences that could easily be extended, hanging plays close to the triple-value white spaces. Marcus played steadily, taking advantage of openings when he could, extending his lead as the game neared its end.

Bunwadde made a small play back near the apex. Was he fishing for better tiles? Trying to keep lanes open to play all eight? Was it just the best play in a bad dish?

Marcus set the question aside. He had to worry about his own play now—until he spotted it. He ran six tiles down and right, hitting two colors, putting a medium-value tense-mark on the white, and making four more short sentences where it overlapped a previous play. "Thirty-four," the board said.

Marcus drew new pieces with a calm he had never felt over the board, not even in his best game against Milinor. He was ahead by fifty-five. He almost couldn't lose.

Then Bunwadde picked up all his tiles. His play put a valuable preposition on another white space, and ran to join a previously extended play. The sentence ran seventeen words in all.

"Fifty-one, and a free play."

Marcus managed to nod through his shock. "Excellent move," he said.

"Thank you," Bunwadde said, drawing the last five tiles out of the bag. If he could play them all with his extra turn, he'd lock up the comeback win. If he couldn't, he might still outscore Marcus in the stretch run.

It didn't really matter. Marcus had played his whole game without a mistake, without fear, without feeling like he couldn't win. That was victory enough.

Bunwadde took time making his play, and was clearly frustrated when he could only lay down three tiles for eleven points. Marcus looked over the board, knowing he couldn't play all of his. He made a partial overlap with four tiles, scoring a mediocre sixteen, going back ahead by nine. He could easily play his last words, if he got the chance.

Bunwadde studied his last two tiles. He laid them down, then picked them back up. The play would have scored seven, not enough. From the glimpse Marcus got, they were a tense-mark and adjective. They might fit with an existing play somewhere, if Bunwadde was lucky.

The board gave a time warning. Bunwadde's bristles were stiff and trembling, and his light-blue complexion had paled. Finally, just after the board's final warning, he bracketed the tiles around a short play up-board, and held his finger over the "*Lustep*" button.

"Dad?" Milinor said quizzically. Her father made a feeble gesture, and his finger fell. It spasmed away when the jeering little song began.

"Invalid sentence. You lose your final turn."

Marcus made his play almost before Bunwadde could take off his rejected tiles. "Nine. Second player wins, 299 to 281."

He felt no outburst of joy, but a release of tension inside him that had been there so long he had forgotten it existed. So much for it not mattering whether he won or lost.

Bunwadde met him with eyes that looked hollow. "Congratulations, Marcus. It seems you have learned quite a lot lately."

"Thank you. I have."

Marcus had scarcely taken two steps into the briefing room before he found someone shaking his hand. He had no chance to extract it from the series of grips that followed, until a much gentler hand took hold.

"Welcome, Mr. Parrish," said Inez Quinones, director of the Language Section. "Good to finally meet you. Please, take your seat."

She guided him toward one end of a long oval table, then sat herself at the other end. Jun Hua, Marcus noticed, was already there at her right hand. He hadn't been part of the congratulating swarm.

"Before we formally begin," Quinones said, "I hope your new accommodations are adequate, Mr. Parrish."

"Oh, they are," he said. "I'm learning to enjoy sitting down again." Several Section members laughed knowingly.

The Section had been ready to buy Marcus out of his service with Bunwadde, once he informed them of the breakthrough the night after his climactic game. Bunwadde was a step ahead, releasing him that following morning. A human had learned Vetra syntax in his employ. He was hoping to minimize the personal repercussions from that connection.

Marcus resisted the impulse to feel sympathy. Bunwadde had brought him there as a showpiece, maybe useful in other limited ways, but certainly no threat. That arrogance had gotten him what it often does.

Still, he'd give Bunwadde credit for two things. First, he wasn't making Tropid the easy scapegoat, yet. Second, Marcus had gone to sleep that night, in the flush of triumph, and woken up the next morning. Not all humans—maybe not all Kevhtre—would have let him do that.

Quinones started the debriefing with a few questions about the preliminary reports Marcus had written on his breakthrough. They seemed pointed beneath her mild way of asking them, looking for some weak link. His system still had a few of those, but he was forthright about them. If the Language Section had suspected some elaborate deception, their residual worries faded.

"It is excellent work," Quinones said, "but your work isn't close to over. We're going to need you to instruct everyone in the Section on the fundamentals of Vetra grammar, in intensive sessions. We need to teach all the diplomatic staff as well, but we may just start with a few critical personnel there. Once some of us are up to speed, we can start acting as teachers for the rest, not to mention spreading this knowledge back to Earth. We'll have—"

"Excuse me, Director," Marcus said. "I intend to give you full reports on the syntactic rules I've learned, nothing left out. I'll even add some work on the link between ideograms and vocables. But I've been indentured once lately. I'm not making it twice. I intend to go home."

"I see," Quinones said coolly. "Why this sudden drive to return to Earth?"

"It's scarcely sudden. I have a life to lead there. I have business to return to—and a new tool with which to get ahead in it. That is why I agreed to this program, after all."

"You were here to crack the language for all of us," one of the members said, "not for yourself."

"I have to concur with Mr. Okoye," Quinones said. "You made a commitment to the Language Section when you agreed to the apprenticeship with Bunwadde. You're shirking that commitment."

"Consider it repayment in kind," said Marcus, "for the level of support I got on-planet. You handed away my full collaboration, not me."

Quinones was perplexed. "Mr. Parrish, I don't understand what I've done to merit this hostility."

"It isn't directed against you, ma'am." He let his eyes creep over to her stoic aide. "Mr. Jun, on the other hand, was anything but supportive of my work. He made my life a lot harder."

Quinones turned. "Jun, what is this about?"

"I'd rather not have my humiliations exposed further," Parrish snapped. "I'll make it short. I want Jun Hua sacked, today, or my assistance will be as limited as I've already said."

"This is—" Quinones couldn't find words.

"Is that all?" Jun Hua said smoothly. "You'll cooperate, over my dead professional body?"

Marcus sneered. "Yeah, I think that's enough."

"Jun, I want to see you—"

"Done." Jun stood up. "Director, I'll be in my office, composing my resignation letter. You'll have it within ten minutes."

The shocked silence was broken by a single bark of laughter from Marcus. "What, that easy?"

Jun Hua turned dark eyes on him. "Nothing is easy with you, Marc, but it was necessary. Indeed, that's why it was necessary. I assumed so from the start."

This time, Marcus couldn't speak. "Jun, explain this," Quinones said.

"Gladly. I learned during the interview process how determined Marcus Parrish is, how ambitious and competitive. I knew we had to harness these traits for him to have a fighting chance at cracking Vetra. So I provided the goads."

He shifted his speech to Marcus. "I gave you String of Pearls, knowing you wouldn't have a fighting chance to win it against native speakers, and that you couldn't resist trying. Then, yes, I rubbed your nose in it. I couldn't risk having you accept defeat. I needed you to pour your whole spirit into making the breakthrough, as unlikely as it might be. But you did it. You beat the odds, and Bunwadde as a bonus.

"So let me ask you, Marc. Was it worth the pain to reach the goal? No," he said, raising a hand, "don't answer me. Think about it. For my part, I'll say it was always worth a high cost to have a human finally achieve mastery of the language. I got what I wanted. I won't shrink from paying a fair price. Gentlemen, ladies." He gave a short bow, and walked out of the conference room.

Quinones's eyes followed him to the threshold, then fastened on Marcus. He found all eyes on him now. "I take it," she said, "that you're on board with us now."

"I . . ."

"Let's be clear, sir," she said, all the gentleness from their introduction gone. "I just lost a very good man because of you. You said that was what it would take to get your fullest cooperation. I mean to hold you to your word."

Marcus said nothing. He didn't look at Quinones, or at anyone.

"We need this knowledge," she said, her tone changed. "The human race needs it. We have to get some leverage in relations with the Kevhtre Union. It's the same problem you face in your business dealings, magnified a million times. If you can't understand how—"

"You don't have to go on." Marcus could barely be heard across the table. "How soon can I start lessons for the Language Section?"

The whole table brightened, Quinones most of all. "I was hoping for tonight."

Marcus tipped his head. "My lesson plan will be a bit rough, but you're right, there's no point in delaying. Tonight it is."

"Done. I'll lend you a staff member so you can pick out a room and get all the materials there you'll need."

"Of course. And thank you, Director," he added, "for that last reminder."

She smiled, as he had hoped. Her appeal to their common humanity had been fitting, but it wasn't the reason he had gone along. Better that they think it was, so they would gloss over what really had moved him: Jun Hua's parting question.

Marcus had endured humiliations, and their sting would last with him. So, too, would the pride of his accomplishment. He wouldn't have that pride if he hadn't gone through the humiliation, been the kind of man who would feel it so keenly, and take it to heart. Jun had read him perfectly.

And Jun had been right: it had all been worth it.

No reason anyone else should know, though. It was hard enough that Marcus knew. ■

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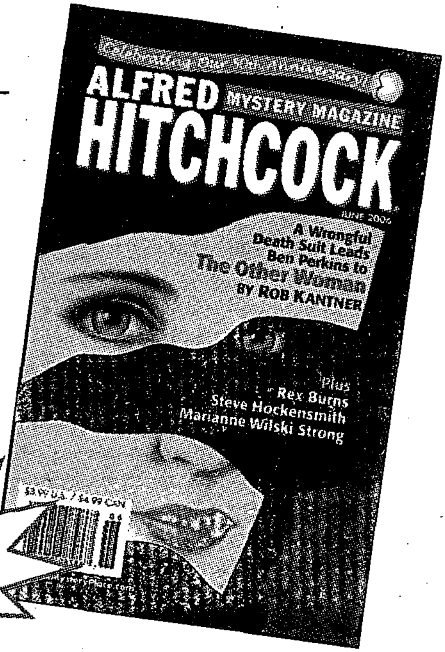
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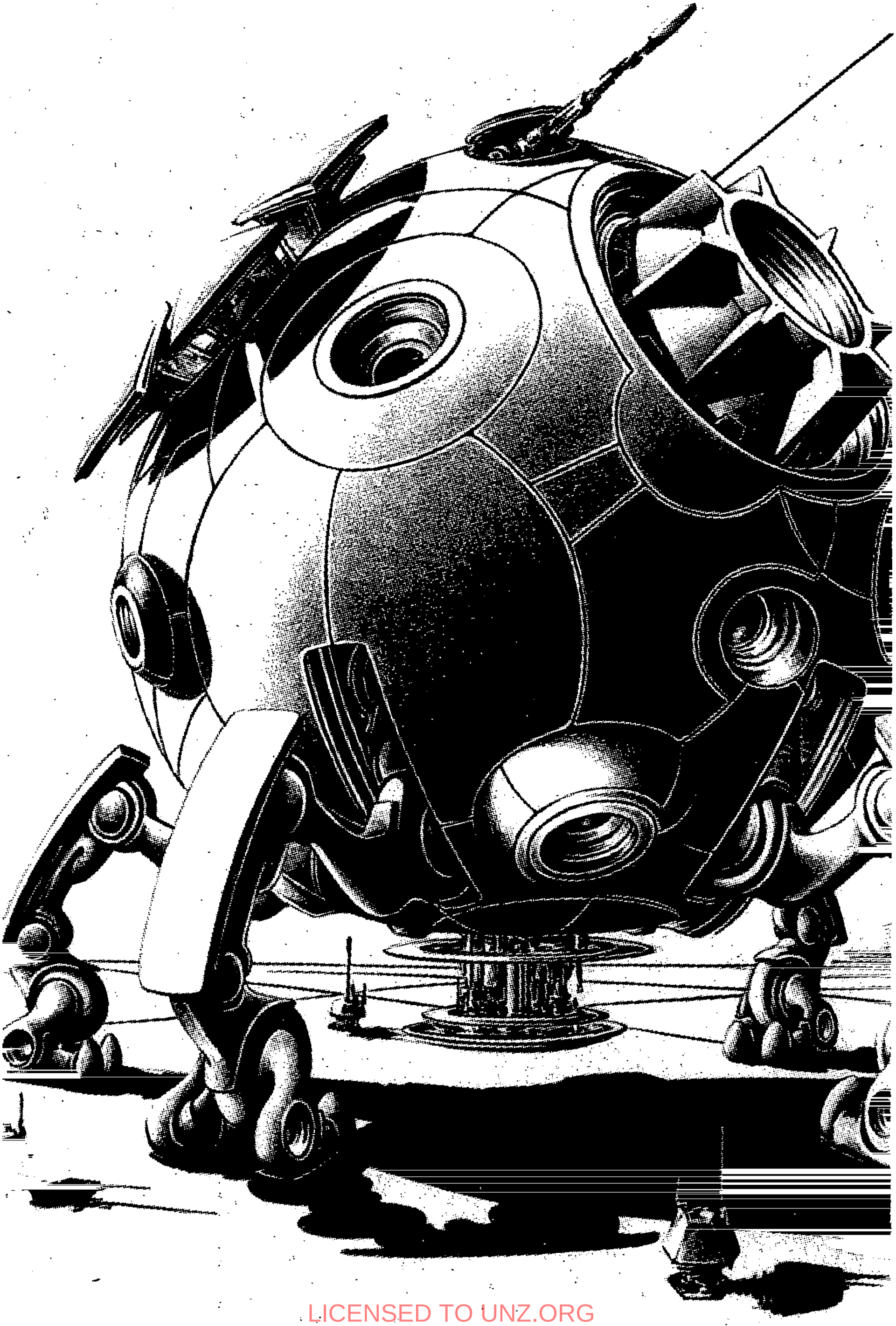


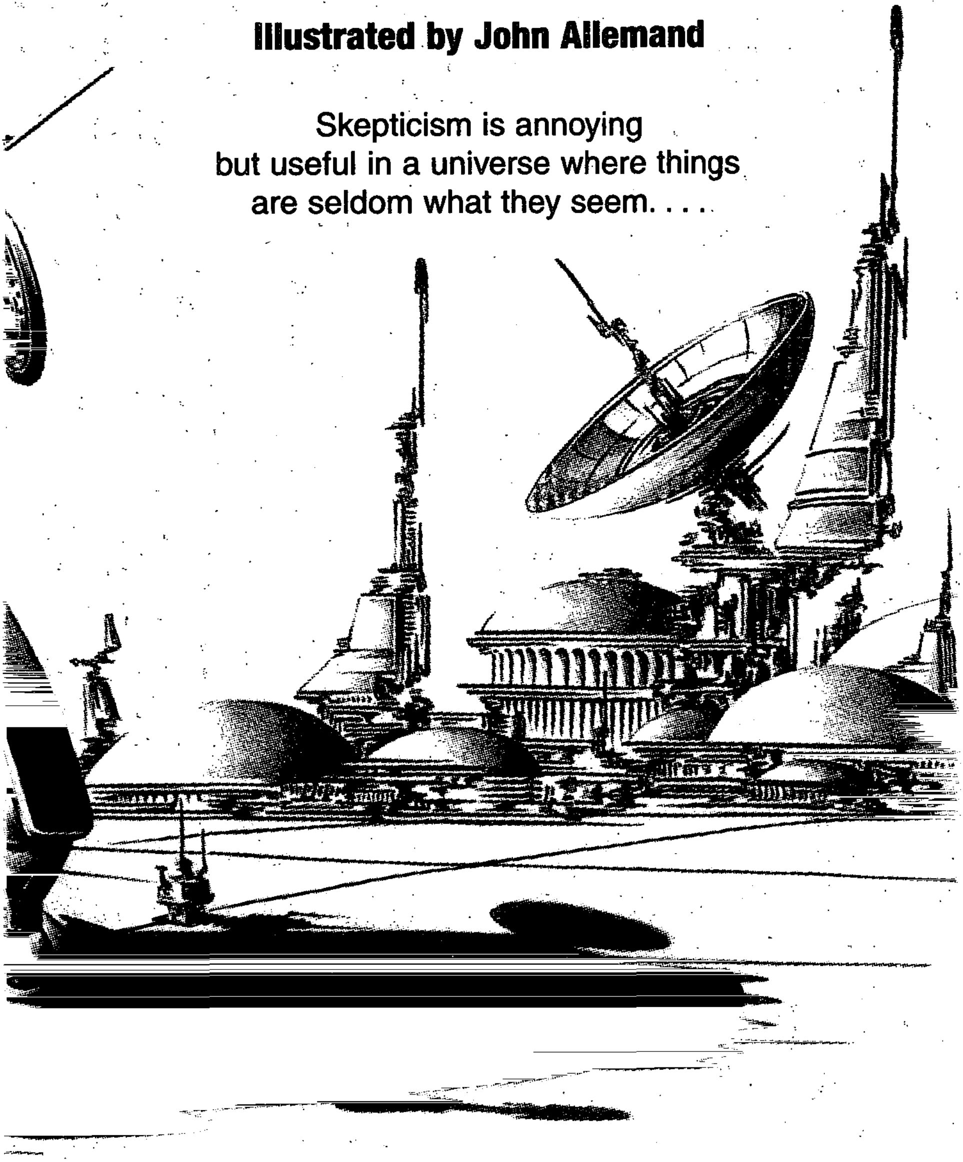
Part III of IV

A NEW ORDER OF THINGS

Edward M. Lerner

Illustrated by John Allemand

Skepticism is annoying
but useful in a universe where things
are seldom what they seem. . . .



Synopsis

For a century and a half, a growing interstellar community has maintained radio contact. A vigorous commerce in intellectual property has accelerated the technical progress of all its members. Travel between the stars seems impossible, but InterstellarNet thrives using an elegant alternative: artificially intelligent surrogates who act as local representatives for distant societies. Quarantine procedures strictly govern the delivery and operational environment of each alien agent, protecting agents and their host networks from subversion by the other.

A radio message shatters this comfortable status quo. The signal comes from a habitat-sized decelerating interstellar vessel, its unannounced trip from Barnard's Star now ninety-nine percent complete. Citing damage en route and a shortage of supplies, the starship Victorious *goes to Jupiter rather than Earth. The starship's crew are whippet-thin, iridescent-scaled, bipedal carnivores who call themselves Hunters. Humans refer to them as K'vithians, after their home world of K'vith, or, informally, as Snakes (because Barnard's Star lies in the constellation Ophiuchus, the Serpent Holder).*

Not only humans are surprised by Victorious' *short-notice arrival.* ***Pashwah****, the AI trade agent on Earth for the Hunters, is also taken unawares. So are her internal sub-agents, the representatives of the Great Clans. Pashwah rejects the starship's unauthenticated demands for Great Clan InterstellarNet credits with which to buy supplies; but she does transmit to* Victorious *a translator and human-affairs advisor: a partial copy of herself named* ***Pashwah-qith****.*

Helmut Schiller *is hiding from a shadowed past: As* ***Willem Vanderkellen****, he had made a major mineral find in the Belt, only to fall afoul of a claim-jumping criminal syndicate. He has found work as a pilot for freelance media star* ***Corinne Elman****, who first breaks the news of the onrushing starship.*

Ambassador ***Hong-yee Chung*** *heads the United Planets response team, based on Callisto. His technical support team includes theoretical physicist* ***Eva Gutierrez****, xeno-sociologist* ***Keizo Matsunaga****, and Interstellar Commerce Union executive and systems engineer* ***Arthur Walsh****. Most humans have forgotten, or at least forgiven, a half-century-earlier inter-species crisis. Art is not among them. The "Snake Subterfuge" involved a trapdoor hidden in licensed Snake biocomputer technology, potentially compromising most human infrastructure. That crisis ended when Pashwah was convinced that one Hunter corporation's extortion plans must not be allowed to compromise overall inter-species relations. The biocomputer vulnerability has long been removed.*

Art finds much the Snakes have chosen to reveal about themselves replete with anomalies. His suspicions grow, as most of Victorious *remains hidden from closely chaperoned human visitors. The K'vithian explanation for picking Jupiter as their destination rings false to Art and Eva, who at different times worked at the UP laboratory on the Jovian moon Himalia. That is where the UP does its interstellar-drive research, and where it produces and stores antimatter in hopes this research will eventually bear fruit. The antimatter stockpile is vastly dangerous; its existence* supposedly *a tightly held secret. Chung remains trusting.*

There is *subterfuge at hand, and it involves a third species. Twenty years earlier, the starship then named* Harmony *was boarded and captured, its crew in suspended animation, on its final approach to Barnard's Star.* Harmony's *rightful crew—a hypothetical human observer would see arboreal octopi covered in green fur—remain* *shipboard prisoners of the K'vithians. The captives are members of the Unity, the intelligent species of Alpha Centauri A, commonly referred to by humans as the Centaurs. The K'vithians had sent a rigged lifeboat back toward Alpha Centauri. The lifeboat radioed a contrived distress call and then self-destructed, to disguise the piracy and make the Unity distrust their own technology.*

***K'cboi Gwu**, the ka (leader by consensus/captain) of the Unity prisoners sabotages the shipboard environmental systems. Only a fresh supply of specialty home-world biochemicals can avert eco-collapse. It is all a ruse to justify Gwu finally revealing the InterstellarNet credits hidden deep within **T'bck Ra**, the long-suppressed shipboard AI. Gwu's captors reactivate the lobotomized AI just long enough to retrieve the hidden financial codes—or so they believe. T'bck Ra has actually hidden himself in computers distributed across the starship.*

***T'bck Fwa** is the Unity's long-time trade agent to humanity. Unity authorities have ordered him to search for human antimatter and interstellar-drive research. His diligent data mining long ago revealed a clandestine human antimatter program on Himalia—and now a K'vithian starship has made Jupiter its destination. Skeptical of news reports that an en route accident destroyed the starship's antimatter refueling capability, he imagines a human/K'vithian conspiracy. His suspicions grow when he learns Unity biochemicals are being synthesized on Earth for delivery to the Jupiter system.*

***Firb Mashkith**, Foremost of clan Arblen Ems and of the stolen starship he has renamed* Victorious, *has more on his mind than the ailing ecosystem. Twenty years earlier when the starship emerged from the outer darkness, no Hunter clan held the technology for antimatter or star travel. As for Arblen Ems, they were out of favor among the clans, hiding on the fringes of their solar system, and hunted to the brink of extinction. His boldness has changed all that.*

*The interstellar drive, however esoteric its theory, is easy to build. Mashkith's problem is fuel. The starship never carried antimatter production equipment. Antimatter intended for its return to Alpha Centauri A was used instead to reach Sol system. Mashkith hopes to trick the humans into revealing how to produce and control antimatter on very large scales. If he succeeds, his clan—alone—will have access to the stars. A carefully contrived demo with antimatter from dwindling reserves convinces human skeptics that K'vith already has antimatter technology. Mashkith's senior officers, **Rashk Keffah** and **Rashk Lothwer**, disparage human antimatter technology. They "allow" human experts to convince them the UP's "primitive" antimatter mechanisms can safely refuel* Victorious. *In the process, the K'vithians master antimatter technology.*

After a second contrived demo, this time of an interstellar-capable lifeboat left pre-positioned in the Kuiper Belt, the UP agrees to trade a load of antimatter for the lifeboat. A triumphant Mashkith gloats about human gullibility. . . .

CHAPTER 24

Art stirred his coffee with reflexes finally adjusted to Callisto. Across the café table, Eva tore morsels from her bagel. Some day he needed to explain to her the accepted meaning of finger food. Or—flash of insight—maybe not. His apparent inability to keep some observations to himself was part of why Maya said living with him involved "more Art than science."

The eatery near their offices was nothing to vidmail home about, but breakfast together was now part of their routine. He knew he looked forward to it.

On the corner 3-V, talking heads discussed the pending constitutional referendum on Titan to legalize polygamy. He ignored them. "What's on your schedule today?"

"Coordinating with folks at Hawking Observatory. Supervising some postdocs at Callisto Tech doing ZPE experiments. Indira Singh finally arrives from Triton this afternoon to talk quantum-string theory. Fun stuff."

Which was to say, doing her best to reconcile the contradictory and inconclusive data about the interstellar drive: oblique hints and condescending comments from the Snakes, indirect observations, subtle inferences. They had precious little hard *fact*, beyond the faint gravity ripples detected during the demo. Getting ready, in short, to take custody of the to-be-transferred lifeboat. She rattled on about specifics, quickly going way over his head.

Mashkith had vetoed Eva's request through Ambassador Chung for one of the lifeboats presently aboard *Victorious*. "The answer would be 'no' if only because we already lack one lifeboat, but safety is not my main reason. I wish to avoid skepticism whether *this* lifeboat truly has interstellar capability. The vessel on its way has already demonstrated its interstellar drive. Your cynics have seen it. *That* is the boat the UP will receive." The Foremost's touchy reaction had only gotten Art further into Chung's disfavor. Abstractly, Art would have thought that impossible.

"I said, 'And you?' " Eva was frowning at him.

"Sorry. Synapse misfire."

"Fine. Don't tell me."

Sigh. "Nothing much." Antimatter transfers did not involve him. The resupply effort was largely complete. "Maybe I'll look into the diminished sulfur level on *Victorious*."

"The K'vithians proved they had antimatter before we seriously discussed refueling. They demoed the interstellar drive we're getting in exchange. Art, you did what you set out to do. Why not relax for a bit? Scale back to, I don't know, six days a week?"

"Do you trust Chung to. . . ?"

She gently slapped his hand. "You're a prime example why that referendum is happening on Titan. Too many men with trust issues."

Before he could decide whether to comment on *that*, she had excused herself and headed off to work.

K'vithians and crew-kindred faced each other in two shallow arcs. A long scroll lay open on the deck between them. Two groups of peers consulting, K'choi Gwu ka thought. *We will be equally dead if we overlook anything.*

A hologram floated above a corner of the printout. As air currents gently vibrated a slightly curled edge, the ephemeral orb morphed from planet to planet. Earth, Jupiter, and Saturn she knew immediately; the names of the other worlds eluded her. The same United Planets logo glimmered from the two shiny cylinders that stood behind the K'vithians.

They contained human-supplied antimatter.

Mashkith's eyes were heavy upon her, impatient. Gwu's experts continued speaking inconclusively among themselves, their words muffled by breathing masks. "Biocomputers are unfamiliar to us, Foremost." *You kept us ignorant lest we meddle with the new networks grafted throughout the ship.* "We must be certain the control approach is entirely compatible with the shipboard systems."

"Nature of concern?"

One of the crew-kindred experts spoke up. "The merest instant of instability during the transfer would be catastrophic."

"Concern for possible transient control states within the interface?" Keffah asked. "Exhaustive review by my staff.

Second review by me. No problems."

Exhaustive? Hardly. The crew-kindred were unfamiliar with biocomps, and the K'vithians had, until recently, disdained to study photonics. *Advanced* species used biocomp.

But photonics controlled the main antimatter-containment chamber which filled half the room. Photonics controlled the interstellar drive powered by matter/antimatter annihilation. *Reassuring myself with thoughts of the Unity's technical superiority.* Sadly, Gwu once more acknowledged her own pride. *I'm not so different from them.* "The Foremost requested our opinion. I thought it best to evaluate the design independently."

The answering growl ended abruptly at a glance from Mashkith, but not before that rumble deep in Keffah's throat rebutted all Gwu's fanciful notions of a meeting between equals.

"Any specific technical reason for delay?" Mashkith asked. "Any explicit unambiguous risk? Your experts' response within three watches, ka."

Which meant antimatter fueling was planned to commence soon after. Reluctantly, Gwu conceded the shrewdness of a deadline. Humans had designed the transfer interface, and *they* knew photonics, biocomps, and antimatter containment. It was prudent to have given the crew-kindred an opportunity to spot anything humans and K'vithians might have overlooked. It was astute to disbelieve any purported problems not accompanied by specifics.

Nothing Gwu had so far heard from her experts rose above musing aloud. Refueling *was* going to happen. Either that, or a very big explosion that would end all their worries. "I understand, Foremost. You will have our response by then." She rolled up the scroll. "For reference as we complete our review."

Returning under escort to their quarters, Gwu decided: We must send our message immediately. Before three watches have passed. Before the remotest chance of an interface mismatch and a cataclysmic explosion, we must send word to the Unity. They must be told the mission was hijacked; it did not fail.

The crew-kindred's only advantage was the secret reactivation of T'bck Ra. They could spring that surprise only once. Should they use their one chance to radio the Double Suns or the Unity's nearby agent?

Hope dies hard, she realized. Gwu could not imagine how help could arise, but at least the theoretical possibility existed that the Unity's agent on Earth could accomplish something before *Harmony* vanished once more into interstellar space. Their attempt to communicate would be directed at the main InterstellarNet receiver on Earth—and through it, to T'bck Fwa.

What course of action the AI could possibly undertake beyond relaying their message was beyond her imagining.

Martian science classes boasted that Olympus Mons was the largest volcano in the solar system. It towered to three times the height of Mount Everest. Its footprint was the size of the Hawaiian Islands.

Long dormant, it was far from the most impressive volcano.

Art's eyes were glued to the apocalyptic sight before him. Vast pools of hot, black lava mottled Io's ocher surface. Geysers and volcanoes spewed sulfurous lava far into space. Rings of fresh red and yellow sulfur encircled calderas a hundred kilometers across. The scene was all the more fearsome for its violent transience: Cavernous faults and tall mountains formed and vanished here in a geological eye blink, as the surface flexed endlessly in the tidal tug of war between mighty Jupiter to one side, and nearby Europa and Ganymede to the other.

As the hellish world swelled in the main screen, Art just barely found his tongue. "Wow."

"Glad you came, Art?" Rachel Shapiro, the scoopship's pilot, wore a condescending smile that said: tourist.

"Absolutely!" And not just because I was getting cabin fever on Callisto. "What a rush!"

"Me, too." Despite the endorsement, Helmut seemed quite blasé, and more relaxed than Art had seen him in their brief acquaintance. That was the thing about new friends—you did not entirely get them at first. The spacer had doubtlessly seen more than Art, maybe even Io before. In fact, Helmut was so bored-seeming Art didn't understand why he had come along.

A different friend's advice had gotten Art here. Clearly he did not yet understand her. After he had made arrangements for two to tag along on a scoop run, Eva politely declined the second seat. Okay, he *did* understand her. Her work was peaking even while his was in a lull. Didn't she need a break, too? He couldn't imagine her taking time off once the working interstellar drive was in her hands.

Maybe thrill rides weren't Eva's idea of a first date. Maybe he was reading her signals wrong. Wouldn't be the first time.

Too bad, either way. She was missing a hell of a show.

Io was only coincidentally a scenic stopover. Their course bent around the tortured moon in a tight hyperbolic turn. The gravity boost flung them all the faster at Jupiter.

The king of planets grew and grew. It became a sky-spanning expanse of wind-driven cloud bands and swirling storms, each feature many times Earth-sized.

"Buckle your seatbelts, guys. We're going in."

Boredom had once obsessed Pashwah-qith. No more: Failure had taken boredom's place. Failure, and fear of its consequences.

Too late, she recognized the weakness in her plan. The InterstellarNet transactions that comprised her secondhand experience dealt almost exclusively with knowledge transfer: inventions, processes, scientific theories. Her customers were large corporations. She dealt with lawyers, financial engineers, and huge banks. Her understanding of illicit dealings was theoretical—and, she was now discovering, seriously inadequate.

Black markets were called black for a reason: Their workings were opaque. Despite her long-sought reconnection to the infosphere, Pashwah-qith struggled to track everything she had initiated.

No-one ran ads on the infosphere for unregistered currency transactions. Prospective buyers had to be sought out, cultivated, and made comfortable. Contacts happened indirectly, through layer upon layer of intermediaries—who had to be sought out, cultivated, and made comfortable. For themselves, everyone strove for anonymity and deniability. From others, everyone sought the certainties and guarantees they were themselves reticent to offer.

Exchanging the Centaur currency was taking far more time than Pashwah-qith had ever imagined.

And some of the shadowy players turned out to be thieves.

Her promise to the Foremost had been simple: overhead not to exceed one-fourth. From that perspective, the slow start-up of the money laundering proved fortunate. She had lost less to swindles and swindlers while learning than had she quickly put more funds in play. Now that she was savvier, she needed—somehow—to speed up the remaining conversion.

Arblen Ems Firh Mashkith was not known for his patience.

CHAPTER 25

Talking with Snakes had become almost routine. That was Corinne's take, anyway; Helmut guessed she should know. This was, what? Mashkith's fourteenth major interview. His second with Corinne.

The hook for today's session was the recently concluded negotiation. The grand swap. Unseen behind the camera and his mirrored visor, Helmut thought it an interesting topic indeed, if not for the reasons Corinne did.

Outing of the antimatter program was a nightmare for the UP military. The entire solar system now knew of the unimaginably powerful and dangerous stockpile there. Where secrecy, the prison cover story, and a few frigates once sufficed to provide security, today it took a fleet to guard the antimatter. *Victorious* had been invited to closely orbit Himalia, inside the security perimeter, the better to expedite fuel transfers.

The Foremost, with untold crew and AIs netted into his head, had *also* acclimated to conversing with aliens. The smooth segues as he changed topics were impressive. Mashkith was quick to talk of the potential for trade and cultural exchange, about the enriching experiences of small shore parties.

Corinne was, as always, hard to distract. "I'm sure everyone who watches will be pleased with the success of those brief visits. You will recall, however, that we were discussing implementation of the new agreement."

"Implementation involves some highly technical matters, Corinne. These are well in hand, and I think best left for consultation between our technical experts. What I find interesting, Corinne, is what diverse items arise in those consultations. Chess, as one example. The crew are quite taken with the game of chess."

"A fascinating topic for another conversation, Foremost. If we could get back to the planning for refueling trials. . . ."

Helmut did not bother fighting the oncoming yawn. He could edit out any wobble the camera failed to remove on its own. The wondrous thing was that he had relaxed enough to yawn. Maybe Rothman decided he had been mistaken. Maybe the man from his past had shipped out while Helmut had been laying low by taking the scoopship joyride. Maybe he had just needed a bit of down time. In the big picture it didn't—

Klaxon blaring and then a shout, both in his mind's ear. "Helmut! You getting this?"

He speed-scanned the past minute from the camera's memory. Mashkith had stopped mid digression. Mid-sentence. "Sure am, boss." As Helmut zoomed in on the Snake's face, frozen in an infosphere trance, Mashkith's eyes snapped back to the here and now.

"Where was I? My excursion to Ulan Bator?" Long pause. "As I think about it, that anecdote is not truly relevant." Another pause. "I realize I've talked on and on about sights that, while new to me, must be familiar to your viewers. Perhaps this is a good time to conclude our chat. I will have you escorted to the airlock."

Almost immediately, the cabin door swung open to admit Rashk Lothwer. A file of guards stood behind him.

Helmut didn't need a net exchange with Corinne to know they had been dismissed and that something unexpected had happened. And that she also could not guess what the emergency might be.

Corridor sensors revealed a guard detachment approaching Mashkith's cabin. They marched briskly for Hunters, not that the prisoner had any difficulty keeping up. His summons had been curt and snarled—he meant for her to be rattled by the guards' tension. Still, a glimpse of the ka coughing and fumbling with her breather mask made Mashkith truly angry at the soldiers. Denying her a few seconds to adjust her equipment had been needlessly cruel.

There was a timorous tapping on the hatch. "Authorization to enter." The escorts wasted no time in leaving him alone with K'choi Gwu ka.

"Foremost." She was hoarse from fumes leaking under her mask.

Talons already half-extended from his hands and feet emerged further. He curled back his lips, baring teeth. "Your mockery of respect for me."

She did not flinch. "I do not understand."

"A lie! Unauthorized message from *Victorious* to Earth. Unauthorized frequency."

She stretched to her full height. "If you refer to an InterstellarNet message, it was authorized by the ka of this mission."

"Your admission of defiance and disrespect!"

"It was a matter of duty to the Unity. Whatever the consequences."

"Consequences certain—despite the failure of your attempt." At Mashkith's thought, the holo display flipped from Jupiter to multicolored schematics. Green threads brightened: the ship's original systems. She would surely recognize those. Red icons sparkled: symbols for biocomp nodes. Those should be familiar from recently reviewing the humans' antimatter transfer design. The image zoomed in on primary communications.

"Security overlay. Protection against rogue messaging, its implementation immediately after our takeover." With an arm stretched into the hologram, he indicated a knot of red beside the main external antenna. At his thought, the tangle flared blindingly crimson. Faster than the red light ebbed to normal levels, the antenna became a faint shadow. Inert. "Power cutoff upon detection of your unauthorized signal. Your mutiny a failure."

"Those whom I serve are prisoners, not your crew." She trembled, but did not back down. "We oppose, Foremost, we do not mutiny. We will continue to oppose, as best we can."

To have maintained for so long the will to resist . . . she was worthy of his esteem. "Failure, regardless. Punishment for the attempt."

"That is for you to decide." Her tremor worsened.

The display viewpoint panned back to encompass the full schematic, even as the diagram compressed itself into a corner of the holo. Into the emptied region he streamed real-time 3-V from sites across the ship. Each scene showed a Hunter cadre waiting before an open panel. "Authorization to continue," he said. In Mashkith's peripheral vision, the ka winced as work crews slashed and severed photonics equipment. Green inter-subsystem links disappeared from the schematic as the procedure continued.

Mashkith knew she would never admit to using the long-withheld Unity credits as bait. That was what the money had been—a lure to entice him into awakening the ship's dormant AI. Its restoration had been temporary only in his thinking. Perhaps no action less drastic than destruction of the ship could expunge that AI now. The partitioning he had just ordered would at least hamper it.

Only after all the targeted nodes were disabled, and the ka returned to the prison zone, did it occur to Mashkith to wonder. . . .

He had permitted his rage to show for effect: a tactic. How much of the ka's apparent defeat had been for his benefit?

Art followed Carlos to an out-of-the-way storefront, whose few window shoppers were long past childhood. They peered through the glass at 3-Vs with bird's-eye views of the local park. Surveillance cameras? "Are you sure about this?" Art asked.

"Your son is what age? Ten?"

"Bart. Yes, he's turning ten."

Carlos clapped him on the shoulder. "Trust me. This is just the place."

Art sincerely hoped so. Any gift he expected to arrive in time had to be put onto a ship soon, and Callisto was not exactly a shopping mecca. He felt guilty enough missing another of the kids' birthdays without compounding the problem with a lame present. Delegating yet again to Maya was not an option. He followed Carlos inside.

The shopkeeper offered an infosphere address and a wink. Art linked in—and grinned. He was suddenly high above a stand of trees, slowly drifting. No, not drifting: banking. The soft buzz of a motor filled his mind's ear. "A micro-plane! Can I try it?" A new address let him do just that. Three times, crashes were averted by some briefly invoked override link. Two near-mishaps were clearly his own untrained doing; the third close call he blamed on a ventilation fan kicking on.

"It's laziness that has me taking control." The shopkeeper had a trace of the North Martian accent Art had grown up with. "The micro-plane is small and lightweight. That makes the square/cube ratio low, which means it's strong like a bug. It's actually fairly hard to hurt one by crashing it. I'm just saving myself a walk to the park if it got flipped on its back or stuck in a bush or something."

Art found himself hooked. "How does it work?"

A box no larger than a deck of cards was set on the counter. A tiny aircraft lay inside under a clear plastic lid. "This is the plane." A holo formed, many times life-sized, into which the salesman pointed. "Titanium wire frame. That little loop coming out the top is for handling; most of my customers use hobby tweezers. Wing cloth is woven carbon nanotubes, very thin and light and strong. Micro-electromechanical motor drives the little prop. CCD camera underneath. It could be much smaller, except that would make it inconvenient to handle."

And infosphere remote control, obviously. "Solar cells in the wing cloth?" Much of his attention remained in the park, swooping and looping.

"Only on some racing models. A nuclear battery is standard."

Art split his attention a third way and queried. A nuclear battery seemed to involve a beta-particle source. There were many designs for collecting the charged particles and converting the accumulating static charge into oscillations to drive a piezoelectric generator.

"Our batteries use a few milligrams of tritium, which has an energy density *way* higher than anything any chemical battery or fuel cell can provide. The beta particles, electrons that is, drive it. The betas from tritium are very low-speed particles, so the thin plastic seal around the battery is more than enough to stop them. As is the dead-skin layer we all wear. The safety rule is the same as for any battery—don't eat it."

Bart would love this. Could he be trusted with it? Art had visions of his son spying on his sister and buzzing the neighbors with the toy. "Umm. Is there any way to control how a kid uses this?" That led to a discussion of programmable cruising boundaries, parental control overrides, onboard image-censoring options, and an audible beeper mode.

He convinced himself: Maybe it wouldn't drive his ex *too* crazy.

The transaction took longer than it should have—too much of Art's attention remained in the little robot now looping the loop above the nearby park. Knowing looks exchanged between Carlos and the salesman suggested this wasn't a big shocker.

They didn't seem surprised either when Art bought a micro-plane for himself.

The fragmentary message forwarded by an Earth-orbiting InterstellarNet relay had been encrypted using a very old—but nonetheless authentic—public key. T'bck Fwa was the only one within light-years who knew the private key with which to decrypt it. In an instant, any satisfaction in detective work well done was washed away by a tsunami of shock and alarm.

"Alert. Alert. This is the Unity starship *Harmony*. We were captured. . . ." End of fragment.

The United Planets were clearly allied with the hijackers. What, beyond impotently forwarding home this message, could he do?

The third watch ended. The fuel-transfer experiment took place.

Mashkith did not bother to ask the result. No one, neither clan nor prisoner, could have survived any outcome other than a complete success.

All that remained was to complete refueling—and one more voyage.

CHAPTER 26

Every inspection trip he made to the *Odyssey*, every visit to a port repair facility or supply store or fuel depot, made Helmut anxious. It appeared he had successfully misdirected Rothman. Would the next encounter end as well?

A narrow tunnel linked Norstead Spaceport to Valhalla City. The passage was thronged, as it always was. He strode casually, the day's business done, jostled occasionally by a hurried passerby. Netted imagery from the overhead public sensors let him look around without appearing to watch. Passengers, crew, spaceport employees—no one seemed to be paying attention to him.

Which proved nothing. Anyone interested in him could *also* be watching over the net.

He breathed easier as he emerged from the long tube into the city proper. Corinne was meeting him for drinks and *dim sum*. Two work buddies relaxing....

A whoosh of cool air swept the pedestrian mall, and a nearby sensor showed him looking tousled. Ducking into a quiet side corridor, his hand went into a jacket pocket for a comb. He found a folded sheet of paper that did not belong.

Helmut positioned himself in a corner where no public sensor could peer over his shoulder before unfolding the paper. The note was terse. It contained only a place, a time, and two words that made his blood run cold.

Frying Dutchman.

The Willem Vanderkellen of spaceport-bar legends was ever wily and in total control. What Helmut remembered, years later, was confusion and panic and improvisation. Chaos, and barely escaping with his life.

A small rock like 2009 Sigma r was more docked with than landed upon. Given a precise tangential approach, there was no rocket fire to draw the eye until moments before contact. The *Lucky Strike* was stealthed, its transponder off; there was no reason to expect any unwanted visitors would choose to reveal themselves on radar. So piercing spacesuit alarms were the first announcement of the claim jumpers' arrival. Whatever ruptured their suits killed Bill and Milos instantly. Kwasi managed only a puzzled, "Who are you?" before meeting the same fate.

Willem was prepping *Lucky Strike* at the time of the attack, by sheer dumb luck on the side of the asteroid opposite the inflated base dome and the claim jumpers. Three flatlined readouts tugged at his eyes and his mind. Grieving had to wait; to dally was to die. He released grapples and boosted at two gees. Radar showed nothing, not even rocks, anywhere near. No one to help. No place to hide. He broadcast a Mayday, but could not imagine it doing any good.

He got a head start of almost a hundred klicks before an IR sensor spotted the hot, side-on plume of another ship emerging from behind the asteroid. As they turned into direct pursuit, the reading dropped sharply, the reaction mass cooled and dispersed by the time it left the ship's shadow. He guessed the brief delay had been to allow the shore party to scramble back aboard.

Willem was out of sight and stealthed—and too near his pursuers for either condition to save him. His fusion drive surely blazed in their IR sensors.

Shutting down now and coasting solved nothing. Those chasing him could extrapolate his current course long after his engine cooled. With a bigger lead, he might have used attitude jets undetected to nudge a drifting ship. He didn't have a bigger lead. Since he was shrieking his position in IR, there was no reason not to monitor the pursuit with an occasional radar ping—and no benefit either, as they remained stealthed. He did not doubt they were gaining on him. They would have given chase immediately and returned later for the ambushers had there been any question who had the faster ship.

They—whoever that meant—had already killed in cold blood to usurp the claim. He wasted no photons in vain pleading for leniency. They wasted none in cynical promises. Not that photons weren't a source of worry: At sufficiently close range, the only difference between a comm laser and a weapons laser was intent. *His* laser was serviceable, but hardly exceptional—not that it could be pointed straight aft. Theirs was surely, at a minimum, the max-rated legal device. It would have no difficulty firing forward.

He had no decent options, nor even a way to judge the rate at which they were gaining on him. His first clue would be their laser painting his hull. Depending how long they waited to fire, it might also be his last clue. Shivering, he programmed attitude jets to vary his formerly bee-line course with some zigs and zags. That might buy him a few more seconds.

Then it hit him. *Lucky Strike*, like its pursuer, was only visible in IR. It was too hot—from its fusion jet, from solar heating—to slip away. The same was *not* necessarily true of the lifeboat, shirtsleeve cool in its bay.

How long until a laser blasted him? Frantically, he disconnected the radar nuller and wired it into the tiny lifeboat. He despun *Lucky Strike* from its temperature-leveling barbeque roll, plunging the lifeboat bay's hatch into darkness. As the bay's heated air was pumped into the ship proper, he suited up. He did his preflight checks with the outer hatch agape, as the lifeboat radiated its modest heat into the black shadows. The lifeboat's environmental systems remained off. At the next evasive zig that gave the lifeboat a slight nudge towards the hatch, Willem released the magnetic couplers.

The continuing acceleration of the *Lucky Strike* imparted a spin to the lifeboat as it slid from the bay. It was his well-loved ship's parting gift to him—a leisurely tumble to slow the sun-heating of the lifeboat. As programmed, the outer hatch slid shut behind him.

Cool, dark, and stealthed, the lifeboat drifted away.

Maybe his pursuers had decided death by laser blast was too quick, or maybe they got greedy and chose to capture *Lucky Strike* intact. He'd never know. Whatever the reason, they observed long enough to identify the recurring pattern of the programmed evasive maneuvers. *Then* they closed the distance—and docked.

His only hope was to disappear without a trace, which meant his pursuers had to believe him dead. He had rigged *Lucky Strike* to explode when attacked. With mixed horror and grim satisfaction, Willem watched his IR view flash white-hot overload as the reactor blew. When the lifeboat's optical sensors returned online, nothing remained of *Lucky Strike* and its assailant but a rapidly dispersing cloud of shrapnel.

Shoppers strolled between storefronts. Kids on maglev boards sped through the loops and corkscrews of an enclosed track. In the mall's central plaza, a water fountain burbled. Helmut sat on the broad rim of the stone wall that surrounded the fountain, waiting.

Ten minutes late, Rothman emerged from a city tram. He approached slowly, trembling. His face glistening with sweat. That's when it hit Helmut: I'm the supposed cold-blooded killer. Rothman picked this very public meeting place because *he* is afraid of *me*.

"I'm actually sorry about this, you know," Rothman said, tugging at an earlobe. Into a lengthening silence, he added, "You don't know what kind of pressure I'm under."

"Nothing I did, I hope."

"No." Rothman laughed nervously. "Here's the thing. Someone is exchanging a *big* pile of interstellar cash. Nothing illegal, just irregular: gray-market stuff. It looked like there was serious money to be made."

"Snake money?" Not that it mattered.

"Nah. Centaur. I don't know why now." Rothman glowered at a group of teens ambling in their general direction. They sneered back, but veered away.

"What does this have to do with me?" Helmut asked.

"A twenty-percent discount should have meant a tidy profit—but there's so *much* sloshing around out there. I can't unload what I bought without discounting even more. And I can't wait for the market to return to normal. I . . . borrowed to make this investment."

Embezzlement? Loan shark? Helmut shrugged inwardly. The reason or rationale hardly mattered. "And?"

"Sorry, Colbert. I need to repay soon, or some people will make things very unpleasant. You understand." Rothman swallowed, somehow apologetically. "I need a quarter million sols."

There was no mention why "Colbert" would offer money, nor of terms. This was blackmail. If he had expected one alias to hide him forever, he would not now be on his third.

Rothman might be as desperate and semi-decent as he seemed. Maybe he would be satisfied with one payoff, not that Helmut could afford even one, and that would be the end of it. Maybe there was honor among *some* thieves. Or maybe Rothman would pocket the bribe and *then* finger him for the far-larger underworld bounty.

Another tacit part of the transaction was an in-case-of-my-death note. Depending how and with whom that message had been left, someone beside Rothman might already know who "Colbert" really was.

Helmut had to assume the worst. His best hope for escape was to leverage Rothman's greed. "I'll need a couple days to free that up as cash. Can we meet here in forty-eight hours?"

Telling Corinne was stupid, but Helmut never hesitated. They talked all night in her hotel room. More truthfully, he spoke for hours; she, apart from incisive requests for clarification, only listened. Reliving the horror *with* someone was cathartic. Despite the ticking of the clock, he kept talking.

"It was a getaway, but hardly clean. I sold the lifeboat to raise cash. And I needed a new identity—fast. If I'd been the hardened criminal the stories make me out to be, I might have known how to disappear. But I'm not. I don't know exactly what went wrong.

"Maybe a serial number on some part of the lifeboat was traced back to *Lucky Strike*. Or maybe someone—a fence, or the doc who sold me this face, or a chance passerby who knew me by my mannerisms—revealed Willem's survival." His escape had cost the lives of everyone aboard the claim-jumpers' ship, and the destruction of the ship itself. "The bad guys had short tempers and long memories. They put a price on Willem Vanderkellen's head. I ran, again."

Corinne nodded. "And so was born the legend of the Frying Dutchman."

"Funny how you didn't seem especially surprised."

"At who you turned out to be? I'm a helluva reporter. Did I neglect to mention that?"

"How?" The next time I slip up, it could kill me.

"Besides your general evasiveness

when, for days on end, we had no one but each other to talk to? It's not like you're a good listener. The final proof was in that ratty old hat of yours. It's quite the departure for Capt. Clean. I got curious enough to have a DNA match done on a hair." She stretched and yawned. "Sorry. That was *not* about you."

"Thanks for not saying anything." Helmut stared at a wall holo, the scene something terrestrial and pastoral he did not recognize. Killing time. Avoiding saying goodbye.

"There's more than one legend of the Frying Dutchman," she said. "Often he's the good guy. Apparently the families of your old crew get anonymous financial support. There's no ambiguity about the gangsters who put the bounty on your head."

And still he sat.

"Get out of here. Take *Odyssey*. Use the shipboard account. Just send me an anonymized message where the ship is when you're done with it."

He just stared at her.

"It's been too long for you, but that's what friends do. Help each other." Corinne gave him a hard shove toward the door. "Now, go!"

CHAPTER 27

Himalia receded slowly in the bridge's main holo. In a nearby tactical display, a swarm of invisibly small UP warships, their positions revealed by their traffic-control transponders, continued their security patrols around the antimatter factory. At this scale, neither display showed the decelerating lifeboat for which the humans had traded years of their antimatter production.

As an unusual sound disturbed Mashkith's concentration, the main holo flipped suddenly into a tiled view of large chambers throughout the ship. He recognized the engine room, mess halls, interior parks, gathering places, and auditoria. Every area teemed with Hunters, crew and families alike, gazing upward into unseen cameras. Puzzled, he turned to the bridge officers.

The soft rumbling deepened. Lothwer stepped forward, licking his lips in satisfaction. "Accomplishment of mission, Foremost. In readiness for triumphant departure. Permission for presentation of status?"

Mashkith could more easily have ascertained the ship's condition with a mental query to a shipboard AI, but he did not. This extraordinary assembly was a ceremony to be savored, no mere accounting to be expedited. "Report of status?"

Lothwer gestured to the arc of officers just behind him. One by one they stepped forward, stiffly erect with pride and accomplishment. "Antimatter containment at capacity." "Hydrogen, deuterium, and tritium all at capacity. Water at capacity." "Biochemicals, Hunter and herd, at capacity." "Sulfur, at capacity." "Metals of all kinds, at capacity." "Clan health excellent." "Shipboard ecology, both zones, returning to nominal." "All on-board auxiliary vessels at full operational readiness. Remaining vessels"—on final approach from charm-offensive visits to Mars and Ceres—"on maintenance schedule for routine engine overhauls." The good news went on and on.

"And morale?"

Lothwer spoke to a camera. "Clan Arblen Ems. Your answer?"

The omnipresent rumbling swelled into a resounding roar of approval. Lothwer saluted crisply.

"My thanks to all hands." Mashkith paused for a deep breath. "To home!"

"Home!" and "K'vith!" echoed thousands of voices.

With cheers still ringing in his ears, Mashkith returned to his cabin. For all his pride and certitude, there was also melancholy at the truth he admitted to himself.

Many would soon die to make real the dream of restored clan greatness, a dream that, although shared by all, they did not fully understand.

* * *

Teak furniture, oil paintings, handloomed tapestries, hand-knotted Berber carpet, a bottle of actual Earth unblended scotch—the room exemplified conspicuous consumption. "Penthouse" was perhaps an odd label for the deepest tier of an underground structure, but no term better fit the pretentious décor.

As Art studied his reflection in a gilded mirror, French doors swung open. Chung swept into the foyer of his suite in Callisto's finest hotel. "I do hope this is important, Doctor. It is quite late."

Why else would I have staked out your rooms? "It is, Ambassador." Art fumed as Chung concentrated on pouring himself a drink. "Important *and* time-sensitive."

"Then please get to the point." And belying his own words, "Can I get you something?"

"I want to go on the flight tomorrow," Art said.

"Yes, well, so do many people, and the seating is limited. You were on a vacation joyride recently, weren't you? Io, I believe."

"That's irrelevant. This is about—"

"I have chosen, and you are *not* going." Art blinked. Chung was never this direct. "Do you know *why* that lifeboat went straight from the Kuiper Belt to Himalia? Why I must fly to Himalia to accept the ship on the UP's behalf?"

"As a token of appreciation they've invited some of the scientists and technicians that have worked most closely with them. Himalia is more convenient for most of them." Final approach of the lifeboat, and everything to do with it, had been all over the news as UP escort ships paced it to its landing.

"Hardly." Chung stared at him. "I am going to share something the Foremost told me in confidence. 'That is the ship whose interstellar drive has been demonstrated. It will go directly to the most secure facility in the Jupiter system. I will *not* have Dr. Walsh accuse me of bait and switch.'

"In short, Dr. Walsh, your rude skepticism has offended our guests. I will not further insult our K'vithian friends through your ill-mannered presence. Consider yourself persona non grata. Now if you will excuse me, *I* have an early flight tomorrow."

Gleaming consoles in front of rows of command seats. Soft-spoken crew working their way down their preflight checklist. Radio chatter with space-traffic control. In a way, this was like the bridge of every vessel Eva had ever seen. And in another way. . . .

Finally, she was on a starship!

"Amazing, isn't it?" she whispered to Ambassador Chung. His nod lacked enthusiasm. He obviously cherished the right and the perk to participate in the turnover of the interstellar-capable lifeboat. Just as plainly, being aboard held no intrinsic interest for him. Too bad he was like that—many would have loved his place on the flight. Art, for one. She had missed him today at breakfast, despite the *bon voyage* dinner he had insisted upon. Art could be sweet.

"Bit of a cold fish, isn't he?"

It took Eva a moment to switch mental gears. *He* meant Chung. In her mind's eye, an avatar winked. It belonged to Corinne Elman, the pool reporter seated on Chung's other side. As the two women netted, more of the group filed in and buckled into their seats. Eva knew most of the guests from other visits to Himalia: antimatter experts and theorists with whom she had worked on hypothetical interstellar drives.

Eva had half-expected to wind up sitting on the floor, but the lifeboat had chairs and adequate headroom for humans. To Art's surprise, the Snakes had promised a shirtsleeves environment. All the passengers' spacesuits were now neatly stowed in cabinets, and they had full view of the controls and crew operations through a crystal-clear partition.

Truthfully, not much so far had met her expectations. A handful of Snakes, their flight crew, had been on the UP ship from Callisto. The lifeboat itself had arrived at Himalia on autopilot. Chung seemed unsurprised to find its airlock locked when their group arrived, muttering about cynics who made life too complicated.

The Himalia scientists by electronic consensus nominated her to ask the question topmost in everyone's mind. Fair enough. She had had more dealings with the Snakes than anyone aboard but Chung, and they could not silently consult a humanist. "Lothwer, everyone is wondering when we will be taking off."

"Soon, Dr. Gutierrez." Lothwer's eyes glazed briefly, presumably confirming status. "We need only to finish integration of the traffic-control transponder. Safety first."

And for reasons of safety first, all substantive questions were deferred until they reached uncrowded surroundings. Operations were easier to demonstrate than describe, Lothwer told them, and the controls would be demonstrated in free flight. Fine, she had waited this long to get onto a K'vithian vessel; she could wait a little longer.

At last, all was ready. Lothwer said a few words. Chung said many words. They boosted slowly, a holo display showing them cautiously making their way past layers of UP warships on patrol.

Surely by now they were far enough out. "Lothwer, I think I speak for my colleagues in suggesting. . . ." She stopped in confusion as her neural linkup dissolved in a burst of static. Mutters and soft curses all around said the failure was not limited to her implant. A suppressor field? Like what was used in prisons?

She was still pondering that odd impression when a soft hissing sound from the air vents penetrated her awareness. Next to her, Chung slumped in his seat. For an instant she felt weary and confused.

Then she felt nothing.

CHAPTER 28

"To recap what we now know, an unexplained catastrophe has occurred in the Jovian system, centered on Himalia. This moon is, was, home to the recently disclosed top-secret UP antimatter program. From the incredible magnitude of the destruction—the very world of Himalia has shattered into three large pieces and innumerable shards—experts now theorize that an antimatter explosion was the root cause of the event. Tremendous loss of life among the scientific community on Himalia appears almost certain."

Around Art, the bridge crew of *Actium* was all focused attention and intense whispers. A data fusion from multiple sensors filled the tactical display. Glowing fragments of the shattered moon dominated in IR. Dense clouds of dust and debris continued to stymie radar and lidar. Just outside the blast zone, identified by their traffic-control icons, hung a small armada of Galilean naval vessels and hospital ships awaiting clearance to enter. Smaller holos were dedicated to media 3-V coverage, but distance and thick clouds of dust rendered their telescopic images all but useless.

"Compounding the tragedy, the shock wave, an intense burst of radiation, and shrapnel from the blast have crippled the UP fleet which had been securing the top-secret facility. None of the few ships to have reestablished radio contact remain flight-capable, and all report significant casualties. Ironically, one victim of the disaster was the K'vithian lifeboat bartered to the UP for antimatter. That small boat was on its final approach to Himalia following a demonstration cruise for UP scientists and dignitaries when the moon detonated."

Eva had been *so* excited about her spot on the lifeboat demo, since she'd never gotten onto *Victorious*. Art remembered thinking how cute she was being. Now *cute* seemed such a disrespectful last memory. She and so many others were gone, their bodies adrift in an expanding volume of debris, perhaps shredded beyond all recognition. His imagination insisted on strewing the dead across a stony red landscape.

Carlos Montoya plopped into a chair beside Art. "You look about as shitty as I feel." Part of that comment was sincere sympathy. More of it was: You're in charge now, so get a grip.

Would Chung have seen the irony, Art wondered. The ambassador's blacklisting had left him the senior member of the delegation. Or maybe Art should credit an ability to piss people off so highly developed it crossed species boundaries. "Sadly, I feel as crappy as you look."

A video crawler made clear he was watching Interplanetary News Net, but Art didn't recognize the voiceover. The famous Corinne Elman was the pool reporter aboard the Snake lifeboat. With the secrets of both antimatter and an interstellar drive to be protected, anything she was going to netcast about this ride was to have been cleared first by UPIA censors. Whatever she knew had died with her.

Victorious swelled in the main holo. At the time of the accident, it had been moving slowly to the outer reaches of the Jovian system. The starship had not changed course since, and its acceleration remained low. Messages had been exchanged, expressions of condolence and puzzlement, but light-speed delay from major settlements had been making consultation with the K'vithians impractical.

Actium had no difficulty overtaking it. Art struggled for words beyond *Eva is gone*, but he had a job to do. "Foremost, on behalf of the United Planets and for myself personally, I am here to extend deepest sympathies for K'vithian losses in the recent accident. May we come aboard?" Will you order the docking platform despun so we can land?

"There is no need, Doctor. Your message is acknowledged."

That was abrupt even by Snake standards. Art stared back at the image on screen. "Respectfully, Foremost, there are matters to discuss. Most pressingly, we wish to make arrangements for K'vithian participation in a UP inquest." And, whispered some insensitive but practical corner of his mind, to discuss obtaining another lifeboat for study.

"*Respectfully*, Dr. Walsh, I see no need to participate in an inquest. The miracle is that such a catastrophe had not already befallen your antimatter program. We have previously shared our misgivings about your . . . technology."

What would Chung have made of that response? To Art, the Foremost's attitude was insulting and sarcastic. "May I ask your plans?"

"We lost crew in the unfortunate accident en route to this solar system. This recent debacle took the lives of more, including technical specialists *Victorious* can ill afford to be without. My plans, therefore, are to rendezvous with our few auxiliary vessels not presently aboard. Then we will depart at once. And before you ask: We can spare no more lifeboats."

Art tried to put himself in Mashkith's place: many years from home, after two losses of crew. Yes, he'd be anxious to head for home, but *this* anxious to leave? "If you wait for a while, I anticipate human volunteers could augment your crew."

"No, thank you." And with equal abruptness, the connection was cut.

Helmut stared blankly at, or perhaps beyond, the radar display. He was too weary, too shocked, too *mad*, to distinguish. Somehow he needed to focus, though, because the autopilot was never designed to deal with space junk whizzing by at the speeds of most Himalia fragments.

Corinne was dead.

He was alone in space en route to Ganymede, to another new name and new life. Why did an old life have to end yet again in tragedy?

He was beyond coffee, beyond the stimulants in the autodoc. He knew better than to start with the booze that called out to him.

Corinne was on the Snake lifeboat because she got the pool assignment, and she no doubt got the pool assignment because she was the best. See where it got her.

Deep down, he knew what was eating at him. On this very bridge, *he* had gotten *her* the scoop. Would she have become the star reporter for all things Snake without his timely intervention? His unending paranoia?

Would she still be alive if not for him?

The continuous media coverage whispered softly in the background. Long years as a solo prospector had honed a knack for balancing diversion with distraction; without effort he tuned out the repetitions and uninformed speculations. His ear homed in on the subtle warble that preceded a news alert. The Foremost would be making an announcement from his ship.

He turned it up, more from habit than from interest. The Snakes had declared an end to the first interstellar visit. *Victorious* was seriously shorthanded after two accidents, and the UP at this time of great tragedy did not need the "interruption" of the aliens' continued presence. Claiming pressing duties associated with preparation for departure, Mashkith took no questions.

Like much the K'vithians had to say, the announcement was short and sweet. And unconvincing. He muted the broadcasts that continued streaming past *Odyssey*. Any further alert tones would override. What was bothering him? What, that is, besides Corinne's death, and all those other deaths, and fleeing the scene while almost every other ship in the Jovian system converged on what remained of Himalia to render whatever help they could.

Victorious was the other major exception to the rule. Maybe that was what bothered him. The people of this solar system had greeted these visitors with open arms. Moved nearer to the disaster, the starship with its vast stockpiles would be a natural base of operations for the rescuers. *He* had a reason to run away like a thief in the night, but. . . .

Helmut squeezed weary eyes in concentration, baffled. So the often inscrutable Snakes were inscrutably not helping. Did that surprise him? What could possibly be driving his suspicions?

To hell with the Snakes and his personal situation. Spacers helped spacers. A hi-gee course correction re-vectored *Odyssey* toward Leda, where one of the improvised evacuation flotillas was converging. Leda, Lysithea, and Elara: all basically co-orbited with Himalia, sharing the same oddly inclined orbital plane. All four were thought to be fragments of a large asteroid long ago captured by Jupiter. Now Leda, Lysithea, and Elara basically shared their orbit with a meteor shower, soon enough another ring for the great planet.

His ongoing struggle to understand the Snakes could wait.

CHAPTER 29

Visualizations in holo tanks, files on the ship's tactical network, downloads to his implant, even strata of hardcopy scribbles burying the wardroom tables . . . information in countless forms surrounded Art. Sensor data from the surviving near-in picket ships. Crew depositions from the same. Simulations of blast dynamics, inferred from radar tracks of selected fragments. Contemporaneous measurements from observatories and ships across the solar system.

Why, Art wondered, can't I pull it all together?

Carlos and Keizo took turns looking in on him. It must be first watch again, because now both colleagues appeared.

"Jesus," Carlos said. "You're *still* up? You have *got* to get some rest."

"Morning." Standing to get more coffee, Art almost fell. The only positive thing about *Victorious* and its slo-mo departure was that *Actium* was keeping pace for now. Acceleration meant drinking coffee from a cup, not a squeeze bulb. "Oops. My leg was asleep."

Keizo reached across the table for Art's mug. "Just walk it off. I'll refill this."

"This isn't very ambassadorial, you know." Carlos peered into the graphics in which Art kept trying to organize the data into something—anything—meaningful. "I'll explain again, in short sentences. You need sleep. It's okay to sleep. The Snakes don't want to talk. Mashkith responds the same way to all queries: He's too busy readying his ship for departure to chat. With Lothwer gone, he'll stay busy. And uncommunicative."

So, Art, stop being stubborn. "I'm convinced there's a big picture here we're not seeing. Somehow, this whole situation makes sense." It *must*.

Carlos slapped the table. "You want the big picture? Fine. Our Snake buddies had a close call, a major scare, on their way here. A few months later they were up close and personal with Himalia for refueling. A few days later it blew. That second brush with disaster is what spooked them, not the few casualties they took on the lifeboat."

"I don't believe that," Art said. "I can't imagine anything rattling Mashkith."

"Perhaps not. I don't delude myself that I can think like him." Keizo looked at the refilled mug in his hand. "Regardless, more coffee is not what you need now."

Art allowed himself to be led to his cabin, but sleep refused to come.

Actium was neither smaller nor more crowded than on his previous visits. Somehow, it was more oppressive. Art paced its corridors, hoping the change of scenery, at least, would do some good.

The clear blue sky above the azure Mediterranean might have been a lifetime ago. Jupiter growing and growing and growing, until there was nothing else in the universe but clouds and the thunderous roar of the scoopship's hypersonic plunge—that had been a few short weeks ago. It, too, might as well have been another existence.

Big scenery. Big picture. Both eluded him. "Complexity is nature's way of saying: 'You're asking the wrong question.' "

Judging from the passing crewman's double take, he had said it aloud. Talking to yourself had to be bad form from the head of mission, even an acting head. Still, the statement was true. Understanding things sometimes involved details, but details should *refine* understanding, not obscure it. *Titanic*: arrogance amid fog and ice. *Challenger*: O-rings turned brittle by cold. Barsoom dome: decades of wind-born dust abraded the anti-UV coating and accelerated aging of the plasteel material.

The long-ago sightseeing rocketplane: a fuel pump rebuilt with a substandard pressure-reduction valve.

What simple statement explained Himalia?

Thirty minutes on a treadmill, warm milk, or total exhaustion—at last one of them kicked in, and Art didn't care which. He slept. When he eventually awoke, it was well into the third watch. Fortified by twelve hours sleep and a long shower, he ordered a huge breakfast delivered to the wardroom he had commandeered for his office.

The tray made better time to the office than he did. Sipping piping-hot coffee, he found the status displays little changed. *Victorious* was a little farther from Jupiter, *Actium* tagging along like a servant or supplicant. Evacuation fleets swarmed Leda, Lysithea, and Elara. Conjecture and data, their boundary indistinct, swamped the infosphere.

One thread of infosphere speculation had been flagged by an aide, "for your amusement." Rather than laugh, what

Art read made time stand still as his thoughts turned some heretofore unseen corner. . . .

Unification: the long-sought physical theory that would conjoin gravity with the other three fundamental forces: electromagnetic, weak nuclear interaction, and strong nuclear interaction.

Cosmologists have long believed that for a very brief interval following the Big Bang, the four forces were, in fact, indistinguishable. Unification of three forces into the so-called Grand Unified Force under early-universe conditions has been experimentally validated. The energy density at which gravity separates from the other three is not reproducible, nor has it existed since approximately 10^{43} second after the Big Bang.

—Internetopedia

The sanctum sanctorum of any ship is its captain's cabin, reason enough to hold a top-secret summit here. Aaron O'Malley, skipper of *Actium*, was another. O'Malley was among the youngest masters in the UP Navy, *the* youngest to hold command of a cruiser. He was renowned throughout the fleet for tactical brilliance, intuitive leaps, and wild idiosyncrasy. His face (or as unsubstantiated whispers would have it, his skin from head to toe) was lined with nanornaments. It was not hard for Art to guess the mood that went with today's lightning-bolt tattoos.

All sides of the captain's study were holos, and surprisingly mundane: darkly paneled walls; oils of seascapes, storms, and ships under sail; an illusory blaze in a virtual fireplace; bookshelves of cloth- and leather-bound classics. The chairs were real and genuine leather; there was no disguising the squeaks. Four seats were occupied: Art and the captain, Carlos, and Keizo.

Art took a deep breath. "There's a big question I cannot get out of my mind. Why are the Snakes so determined to leave *now?* I'll be honest—I have a theory. If I'm right, it's pretty damn horrifying. I asked everyone together because we all approach problems differently. Nothing would please me more than being shown the error of my ways.

"The stated reason is simple caution. They're shorthanded. Mashkith wants to leave before he suffers any further mishap. Captain, does that work for you?"

O'Malley leaned back in his seat, hands behind his head, fingers interlaced. "The navy ferried the Snake crew to the lifeboat, and there were only four aboard. Losing *any* crew is tragic, but is it a big risk? We've never gotten straight answers about the size of the ship's complement, but look at *Victorious*. It's enormous. Deep radar scans show just what you'd expect: It's a warren of caves and tunnels and decks. The supplies they took aboard likewise imply a large population. We've seen up to a dozen aux ships flying around at the same time, maybe a hundred individuals playing tourist.

"I agree with your suspicions, Ambassador. Four casualties do not justify the unseemly haste with which they are suddenly leaving us—especially since their return flight will take them . . . what? Roughly twenty Earth-standard years?"

"Just Art." I'm no diplomat. "Anyone else? Keizo, you look unconvinced."

"Our visitors were very disparaging of our technology. They emptied and returned our antimatter transfer canisters very quickly. They imply our technology caused the disaster on Himalia. Perhaps they fear another such incident, and a worse outcome the next time."

"Crap," Carlos snorted. "There's nothing left to endanger them. Our only antimatter program was on Himalia. No one at UPIA has figured out how the Snakes penetrated our security and *found* Himalia, but having done so, they must know we have no other program. Art, you're killing me here. What other reason is there?"

Another deep breath. "Complicity in

the disaster. They want to be gone before we think of that."

Seconds went by without anyone calling him crazy. "Okay, let's explore this scenario for a bit. If Snakes were involved, when would the Himalia explosion have occurred? Not before *Victorious* was fully refueled, of course. That leaves only a small window. Not as the lifeboat first approached, nor as it landed, nor as it sat locked and waiting for passengers to arrive for the demo trip." If I'm not imagining all this, Art thought, how convenient my skepticism was for the Foremost. It helped justify keeping the lifeboat off-limits and unexamined. "Had the factory blown up at any of those times, we would certainly have seen a connection.

"What about later? Could an explosion be planned for after the lifeboat's safe return from the demo flight? No, because that timing might permit the lifeboat's new, human owners to discover and disable the trigger. If this line of reasoning has any merit to it, the best time to cause an 'accident' would be precisely when it *did* happen—as the lifeboat approached Himalia on the return leg of the demo flight."

O'Malley's eyes glazed briefly. Ship's duties? Fact-checking about this conversation? "I agree, to a point. If the Snakes were involved, they'd want to get away before their guilt is suspected. And I agree the timing is suspiciously supportive of such involvement. But you haven't said why they would. As to how, a big-enough, near-enough EMP could have killed the containment. There's no evidence of one."

"Valid points," Art said. "Among the more interesting topics on the infosphere today is the 'silver lining' blog among cosmologists. Observatories across the solar system reported a brief gravity wave around the time of the incident. There is much uninformed speculation about truly *huge* quantities of antimatter on Himalia, enough for the explosion to have recreated for an instant the conditions that immediately followed the Big Bang. That conclusion is nonsense, but the gravity pulse—that *is* significant. Observatories also saw a gravity wave when the Snakes demoed the lifeboat out past Pluto.

"Suppose the interstellar-drive mechanism manipulates gravitational forces." Just don't ask me for details. This was getting into Eva's theoretical approach to interstellar travel: modifying the properties of space itself. For reasons she could never make Art understand, there was no theoretical requirement for Newton's gravitational constant to be, well, constant. Modifying G locally would have the effect of creating a local propulsive gradient. Rolling downhill between stars, she called it. There was a lump in his throat he could not deal with now.

"Every indication is their drive can't be used deep in a gravity well. They've told us that, and we know they stopped decelerating with their deep-space drive once they got close to Sol system. Would a drive that did not rely on gravitational forces be sensitive to gravity?"

"What are you suggesting?" As Art hesitated, Carlos said, "If you ask me, Ambassador Chung didn't know what a resource he had in you. He belittled what I consider a healthy skepticism. In my line of work, we embrace it. Paranoia is a positive trait when it keeps you alive."

What *was* he saying? He had a hand-wavy, qualitative hypothesis. The people—first and foremost, Eva—best qualified to critique it were nowhere around. Maybe their absence was another point in favor of Art's hypothesis. "The gravity pulse is the key. I can't give you details, but I believe the interstellar drive harnesses the energy from matter/antimatter annihilation to manipulate gravity." That didn't mean Big Bangs on demand. It had to involve some interaction that was both subtle and controllable. "But once you wrap your head around a gravity theory advanced beyond anything we humans know, you have to wonder if the Snakes have found the holy grail of physics: a theory that unifies gravity with all other fundamental forces. Because one of those fundamental forces is electromagnetism, and it takes strong, precisely modulated EM fields to contain antimatter in BECs.

"Here's my theory," Art continued. "The obstacle to using the drive inside a solar system is the complexity of controlling the EM side effects. Those side effects can be calculated and compensated for—but only under simple circumstances. In deep space, that is, with no large masses around. Now think about our neighborhood, and the pull of Sun, planets, and the dozens of moons of Jupiter. Switching on the drive in that dynamic environment would be suicidal.

"Imagine for the moment that the Snakes *wanted* a catastrophe. They activated the drive where it can't be controlled. The ripple took out the antimatter containment on the lifeboat. Maybe the ripple was enough to directly kill containment a couple thousand klicks away on Himalia. If not, all it takes is for radiation and debris from the first blast to unsettle one BEC container left on Himalia."

Keizo broke the moment of stunned silence. "I'm the least qualified person aboard to comment on the physics. It seems to me, however, that an overarching question remains unaddressed. *Why?* Why would the K'vithians *do* this?"

"Allow me." When had O'Malley's cheek tattoos turned to skulls? At his unvoiced thought, one wall of the cabin morphed from old English study to a close-up of *Victorious* sliding through a field of stars. "Professionally, I'm impressed.

"First, they're fueled. Since we don't have the lifeboat as an interstellar-drive prototype, a cynic"—and he winked at Art—"might say they stole that fuel. Worth, I'm guessing, a few months' GDP for the whole solar system?

"I'm merely your chauffeur, but you'd be surprised how high my security clearance is. Before agreeing to allow my ship anywhere near an antimatter bomb test—and let's be honest, that's what Art's first little experiment was—I used that clearance. The Snakes talked a good ball game about their advanced antimatter technology. I saw no evidence they have such a thing. In fact, they were a bit slow on the uptake with our technology.

"I don't believe our buddies in that big old starship knew how to manufacture antimatter. They wanted our technology as much as a load of fuel. More: If all they wanted was a trip-worth's load of fuel, they could have stayed home and saved themselves forty years. The main point of this trip must have been to Enron us out of our technology. How am I doing, Art?"

So well it was scary. "Dead on."

Keizo looked ill. "But why all the killing?"

"Because," Art said softly, "maybe it's not enough to steal away—*if* we can follow. Maybe they thought we could reverse-engineer their interstellar-drive technology from observing it in operation. Or perhaps we're closer than we realize to having the capability on our own. Regardless, they hoped to discredit our antimatter technology so completely we'd be afraid ever to use it again. That's why we got the disaster Keffah superciliously warned us about." And more sadly: "And that's why they slaughtered our experts. There's no one left to refute their lies, no one left to rebuild our capabilities."

Hands shaking, Art got up to pour himself coffee from the captain's urn. "You're wondering how, if they lack the technology, they ever got here. That's something I can't answer."

"Actually, that's a question that can wait." O'Malley zoomed the holo until *Victorious* filled the cabin. "I'm asking myself something quite different.

"What are we going to *do* about this?"

CHAPTER 30

Two refugee families were shoehorned into *Odyssey*. Together that meant four adults and five kids. There was room aboard for little more than the clothes on their backs; a cat and a parakeet, both vocal, in separate cages; a few tattered stuffed animals.

They did not fill the void Corinne had left.

The parents were glued to the news. In their circumstances Helmut would be too, but now he tuned it out as an unproductive distraction. Much of the shrapnel that had until recently been Himalia was moving *fast*. Even a small chunk at those speeds could be fatal, so he had all the ship's sensors set at max sensitivity. His eyes were stuck to the main holo tank, in which all sensor data and calculated course projections were integrated.

Radar showed vessels swarming around Leda and Elara; Lysithea was presently under bombardment and too dangerous to approach. The space-traffic-control display added the transponder IDs of the evacuation ships. There was a bubble in the flow, with transponder-equipped ships giving a wide berth to *Victorious* on its contrary path, and to the UP vessel trailing it. The starship's fusion drive "burnt" hotter than most everything else in his false-colored IR view, hotter than the flotilla of would-be rescuers, hotter than the final returning Snake auxiliary vessels.

Helmut did not much care for the Snakes. He had not trusted them since he and Corinne realized how that stentorian radar ping had been used to manipulate them. How like the aliens not to help after the disaster.

He was not one easily to accept accident as an explanation, especially in matters of life and death. Corinne was dead; he wanted a reason. Conventional wisdom may have converged quickly on an industrial mishap as the cause of the Himalia disaster, but he wanted proof. How like the Snakes to belittle UP technology as the cause of the accident.

The few facts and many speculations had yet to crystallize a vague dread Helmut could not yet articulate, leaving him to stare into the display, oblivious to his passengers. Radar echo plus transponder icon, with or without the IR flare of a fusion drive in use, equaled a ship. Radar echo without transponder icon equaled a meteor. And the lone IR source showing neither a transponder nor a radar presence?

That combination generally meant someone up to no good.

Art squirmed in one of two bridge chairs. Small ships triggered his claustrophobia, and *Odyssey* was tiny. He could not keep his eyes from straying to the ship's single airlock, the only exit in case of a problem.

Helmut looked offended. "It's fine with me if we go next door."

"Next door" meant *Actium*, still shadowing the slowly receding *Victorious*. Why, when Mashkith insisted an exit was so urgent, that departure remained leisurely was merely the latest Snake enigma. Whatever the reason, *Odyssey* had easily caught up.

After the Himalia disaster, the UP navy had tightened security. That included a background check before any civilian ships were allowed to approach. Carlos summarized the investigator's findings as, "Your drinking buddy is underage." The comment had been too obscure for Art. It turned out to mean there was no credible record of Helmut's existence until five years ago. Did that make Helmut a spy, a master criminal, or someone in the witness protection program? Art's questions got only shrugs in return.

Whoever Helmut really was, he was a friend—one who had also lost someone in the Himalia blow-up. And ambassadors, even acting ones, have some prerogatives. "Be happy you were permitted to dock . . . whoever you actually are. Now what's this about?"

"Something important enough to drop out of the evacuation operations. Something important enough to risk personal exposure. Who I really am doesn't matter right now."

"What does matter?" Art asked.

"That I'm certain someone well-placed in the government has seen this." At an unspoken command, Helmut's main display holo panned back. On the periphery of the display volume, hotter than anything on the screen but *Victorious*, the IR view now revealed a tiny fusion flame. There was nothing there on radar. The trajectory recorded for the unknown ship climbed at an angle steeply inclined to the ecliptic.

Its course was toward Barnard's Star.

A TEOTWAWKI alert got Carlos out of bed. If that hadn't worked, Art was prepared to have the marine guards assigned to him as ambassador break down the cabin door. Art's message contained a capture of the holo, the dot representing the stealthed ship set to blinking, and a bit of text: Confirm or refute this data.

The response five minutes later was even terser: Bring your buddy aboard. Marines waiting on the *Actium* side of the docking collar escorted them to Capt. O'Malley's cabin. One of the previously "paneled" walls now showed something like the main display on *Odyssey*. Art did perfunctory introductions. Carlos made no comment on the name "Helmut"; he might have been netting volumes privately to O'Malley. It didn't matter. Art plunged ahead. "That course implies a Snake vessel. The fusion drive, hotter than humans use but like *Victorious*, says the same."

"And if it is?" O'Malley asked.

"Remember how the Snake lifeboat went straight from deep-space demo to Himalia?" Carlos and O'Malley surely remembered everything about the apparent weapon of Himalia's destruction. The probably Snake-caused catastrophe consumed them no less than it consumed Art, as they all awaited direction from the politicians and admirals on Earth. "I keep thinking of something Ambassador Chung said right before the lifeboat demo. Chung claimed the Foremost sent the lifeboat straight to Himalia lest I accuse the K'vithians of bait and switch.

"What if *they* engaged in bait and switch?"

O'Malley frowned in concentration. "You're suggesting the lifeboat that we tracked all the way to Himalia, the ship our VIPs boarded, isn't what blew up. That this stealthed ship is the one with our people?"

"I am," Art said.

"On top of destroying and discrediting our antimatter program, they'd get our best scientists." O'Malley stood to stare into the holo. "If they could pull it off, it would make sense. Hell, it would be brilliant. How could it be done?"

Helmut cleared his throat. "You track the Snake vessels, right? After the circus when they arrived, their ships began flying with UPAA space-traffic-control transponders."

"Right," O'Malley agreed.

"I don't suppose I could have access to the Jupiter region's UPAA data base." Helmut shrugged at the cold look from Carlos. "In that case, I suggest someone there do a bit of data mining. The query: Find the ten closest approaches by a Snake vessel to the final course of that lost lifeboat. Timestamp them." To inquiring looks he answered only, "Bear with me."

The regional data center on Ganymede took twenty minutes to respond, of which only a couple minutes could be attributed to round-trip light-speed delay. Time enough for O'Malley's steward to arrive with fresh coffee, and to drink it. Time enough to pace and fret.

A soft chime announced arrival of the response. O'Malley cleared a third wall of his cabin for its display. Ten swooping red paths around and grazing Jupiter:

scoopship runs. One yellow path likewise shooting by Jupiter, but going no nearer than ninety-thousand klicks to the cloud tops. On its way down, the yellow track zigged and zagged on a path everyone had believed represented lessons for the passengers on the flight controls. The yellow trajectory never came terribly near a red one.

The graphic told Art nothing. "Helmut, is this what you expected?"

"No." Helmut softly drummed fingers on the tabletop. "I'm missing something."

Was Helmut imagining things, or was Mashkith yet again a step ahead of them all? The latter would not surprise Art. He considered himself a decent amateur chess player. Maybe a month after he had made a gift of a chess set, the Foremost visited Callisto. Art had offered a friendly game; Mashkith had mated him in twenty-three moves. How many moves ahead had Mashkith plotted the visit of *Victorious*?

Dammit, this was no time to lose confidence. It might not be too late to save Eva and the others! "Call the lifeboat with our people A. Helmut, you think the Snakes dropped off a stealthed lifeboat, call it B. That at some point the Snake crew took over A, stealthed it, and destealthed B. B returned to Himalia, remotely operated or on autopilot, to trigger the explosion on its final approach. The mystery ship you spotted is A, and our people remain on it."

Helmut nodded agreement.

"I begin to understand your interest in scoopships," O'Malley said. "Lifeboat B must have been sneaked into position. Once *Victorious* was in the neighborhood, no ship could leave it without risk of being seen. Nor could B have been pre-positioned in deep space, as lifeboat A was. B approaching from deep space would have meant major deceleration, too much time at risk of being spotted on IR. But couldn't *any* of these scoopships have ejected a stealthed, transponder-less lifeboat? What is this traffic-control download telling us?"

"Fair question. Any ship meant to be kept secret must avoid chance discovery by passing human ships. Stealth and lack of a transponder would help, but as you say, there's no disguising an in-use fusion drive." Helmut pointed at the holo spark of the distant, stealthed ship on which Eva and Corinne and Chung might still be alive. "Drive exhaust is how we spotted this. Somehow they needed to deposit B directly in the right place to begin. . . ."

Helmut felt himself grinding to a halt. How many days had it been since he had slept longer than a catnap? Fear of being sold out by Rothman; a hasty flight, interrupted by the Himalia catastrophe; the evacuation run to Leda and back to Callisto; overtaking *Actium*. . . .

Stay on task, and think sneaky. "Sorry. I'm slow today. Captain, can you add something to the display? Close approaches made by our lifeboat to any moon." A new icon appeared in the holo. On the inbound leg of its flight, Lifeboat A passed close by the minor and very inner moon, Adrastea. It orbited deep inside Jupiter's magnetosphere, a very hard radiation environment where people never went.

Maybe, thought Helmut, I'm *not* hallucinating. "Okay, here's a new UPAA query. Show ten closest approaches by Snake ships to Adrastea."

Coffee and doubt gnawed at his gut while this time thirty minutes passed. At a chime, the final wall lost its faux paneling. In its place, a gray blob hung in space surrounded by the red arcs of passing ships. Adrastea was twenty-six klicks along its long axis; that provided a sense of scale. The red flybys were close, some only a few hundred klicks away. "That's it."

"Very clever." O'Malley tipped his head from side to side, studying the newest holo. "One of these flybys ejects lifeboat B, some time when no human ships are around. B waits on Adrastea.

Eventually, lifeboat A coasts by with its active transponder. B takes off and matches course. At the appointed time, A goes stealth and turns off its transponder. B destealths and mimics the transponder on A. There's never more than one drive running. From a distance, no one could tell."

"But what if a human ship . . . oh, I see. That's why A followed such a corkscrew course. Killing time because some human ship might otherwise have been too near Adrastea when it arrived. We thought it was flight training." Art laughed softly to himself. "No wonder Mashkith trounced me in chess."

Helmut could feel the final pieces falling into place. "Lifeboat A is diving towards Jupiter when B takes its place. So A continues its dive, only it uses its engines to alter course a bit. Jupiter slings it out of the ecliptic. And there," he pointed, "it is."

Spacers help spacers. First of all, they help shipmates. "I say we go get them."

CHAPTER 31

The first hint of danger came perilously late.

Arblen Ems Rashk Lothwer was quietly reveling in the satisfaction of his own command. His crew was handpicked. The ship was well engineered and well built, and he had proudly named it *Valorous*. They were necessarily flying semi-blind, making lidar sweeps ahead for space junk in their path, but emitting nothing behind that might reveal them. Nothing but their undisguisable exhaust.

Lothwer's only complaint, as they slipped stealthily away, was with the low acceleration on fusion drive. The herd designed for efficiency, not fast getaways. As a lifeboat, a few more days exiting a solar system by fusion drive hardly mattered since years under interstellar drive would follow. On this mission, though, the small fusion engine meant that much longer before they safely exited the zone of likely detection.

Caution was appropriate, but it did not distract from the facts. This operation, *his* operation, had gone smoothly. The Foremost was stingy with his approval; the recognition due this mission—due *him*—would be all the more precious for that. Naught remained of this operation but a triumphant rendezvous a few days hence.

Four brilliant heat sources suddenly flaring in his passive IR sensors shattered Lothwer's complacency. They had to be ships in pursuit, flipped to decelerate. Their presence disclosed, one broke radio silence. "Unidentified K'vithian ship, this is the UP frigate *Nelson*. Destealth immediately and maintain course."

No harm now in a lidar scan backward. Blue-shifted echoes showed his pursuers moving at three times his speed and closing fast. To get secretly as close as possible, they would have waited to the last moment to apply the brakes. The math was simple; they would be upon him within hours.

His sole advantage was the value of his prisoners. Had those giving chase not wanted to capture *Valorous*, the first hint of their approach would have been a flyby, close-range laser attack. Cursing softly as he sorted options, Lothwer added a second complaint to the short list of the ship's deficiencies. Its only weapons were anti-space-junk lasers.

Valorous could neither outrun nor outfight the enemy. It had to evade them. The good news was his stealth gear could fool more ships than had been sent after him.

Lothwer cut the fusion drive, disappearing for now from the enemy's IR sensors. Projecting his course was a simple exercise in ballistics—but *Valorous* remained distant enough that extrapolations would be imprecise. The uncertainty would grow until they found him optically. It was a weak ploy, he admitted to himself: Four pursuit ships could share data and triangulate bearings. Once the first UP vessel got close, the hull of *Valorous* would be warm enough to betray them.

As tactics officer, he had drilled and drilled—assuming the use of Hunter ships. His reflexes and instincts were off for this encounter. And while he did nothing, the enemy ships crept closer and closer in the tactical display

Valorous must try to leave its projected course, and his adversaries in the other ships knew it. He could conceivably flip and change course. Whatever way he turned, some pursuers would have an oblique view of his fusion exhaust. Triangulation would make plain where and when he was coming. And almost certainly there was a second, slower tier of ships waiting just for that, still in stealth mode. Maybe a third set.

What could he change? *Valorous* had chemical attitude rockets. Fired in proper sets, they would nudge its course rather than pivot it about its center of mass. Would that be detected? If only he knew the capabilities of UP military sensors. If only he had brought decoy rockets.

Thoughts of things he did not know and did not have were unproductive. What *did* he have to work with? An interstellar drive that would be suicide to activate this deep in the solar system. The antimatter, explosive beyond belief, to power the presently useless drive. A simple timer or detonator to deactivate containment would make the fuel canister a powerful bomb. Too powerful, even if he could improvise a way to deliver it, because it was all in a single canister. The eruption of radiation from that large a matter/antimatter annihilation event would kill *Valorous* as surely as its pursuers. And yet, Lothwer thought—

If he could not contrive an escape, extravagant destruction would be their mutual fate.

Long ago and far away, Mashkith's grandfather had taught him b'tok. Those times were among his earliest and fondest memories. Grandpa had been thoughtful and patient, yet totally engaged until each lesson was mastered. Wringing every bit of potential advantage from any situation. Enduring, when no other option presented itself, until prevailing becomes possible. Discerning the distinctions between swiftness and haste, between thoughtfulness and indecision. Anticipating countermoves by his opponent, and his own counter-countermoves, before making his own move.

At first he and Grandfather played in the small central plaza of their habitat. Grandpa insisted it was important to learn to concentrate despite distractions. Eventually, Mashkith noticed people often whispered as they passed, or gave them sidelong looks. Grandpa would not explain. After Mashkith questioned him too many times, Grandpa moved their games into the small family apartment. Mother always told him proudly how Grandpa had been a great leader, Foremost of the clan; Mashkith imagined *that* was why people acted as they did.

Mother and Grandpa had sheltered him as best they could, but that protection ended when Mashkith entered clan academy. Classmates were cruelly quick to tell him the whole story. His grandfather had disgraced the clan, had cost Arblen Ems its rightful place among the Great Clans, had doomed them all to exile and desperate hardship. Didn't he know? Amid their endlessly inventive acts of harsh and sadistic revenge, through the cold indifference of the teachers and officers, Grandpa's lessons in concentration and will sustained him—even as he could not help, in his innermost thoughts, from raging at Grandfather for his shortcomings.

If b'tok was a metaphor for life, then the aim in life was winning. Mashkith had endured, because for a long time no other option presented itself. He had endured until prevailing became possible.

With concentration Grandpa would have admired, Mashkith relegated to a distant background the purposeful motion and conversation on the crowded bridge. In the secondary tactical display, Lothwer's peril was obvious. Besides the four closest pursuers, those that would now be visible to Lothwer, from the vantage point of *Victorious* four more ships could be seen giving chase.

Someone on the human side knew his business. Backtracking showed the converging UP vessels had begun their pursuit hidden behind Jupiter. Given that head start, the armed Hunter ships aboard *Victorious* could do nothing in time to help. Likely more ships were stealthily en route from the inner solar system, waiting to exploit any hasty move the clan might make. A sortie right now from *Victorious* could be such a mistake.

As Mashkith watched, the icon representing the lumbering lifeboat Lothwer had named *Valorous* flickered before fading to the dim sphere representing an extrapolated position. Lothwer had cut the fusion drive. It was the correct move—but insufficient. The sphere slowly swelled to match the growing uncertainty in the ship's no longer trackable position. The sparks representing the enemy ships in chase edged ever closer.

Mashkith could not help thinking: Grandpa, had you not overreached, I could have crippled the UP military at will. The trapdoor hidden in for-export biocomp was for just this sort of emergency.

Grandpa's ghost had an answer: Had I not been ambitious, you would not now command this fine vessel, poised for greater glory than anything I ever imagined. Now do as I taught you. Focus on the problem.

Nothing *Victorious* could do would help the fleeing lifeboat. But Lothwer was crafty. What if little *Valorous* evaded pursuit? What then? Mashkith's thoughts began evaluating actions Lothwer might take, options he could exercise. If he did *that* then the UP forces might do *that*. . . .

The next move, right or wrong, was in Lothwer's hands. The countermove was in the hands of the humans. But as for the counter-countermove. . . .

Thank you, Grandpa.

The four ships stalking the still invisible *Valorous* continued to narrow the gap. A newly revealed second tier followed. The humans were *serious*.

They had cause, Lothwer was willing to admit. What was the death toll from the Himalia explosion? *Valorous*' outbound path had sometimes passed through human media broadcasts, both 3-V and unencrypted infosphere. Each time, the reported havoc was worse. Lothwer told himself Himalia itself and the picket ships had been military targets. He could construct no such rationale for the hundreds more who had died on the co-orbiting moons, or in accidents among the evacuation ships. Surely thousands, total, and mostly civilians.

Would the humans be any less vengeful than any clan would be? Instant death by antimatter explosion would be merciful.

Reconciliation with his fate strangely calmed him. *I have nothing to lose now; only the humans do. Why not be bold?*

Bright points shone in the holo, taunting him. They would soon surround the sphere of uncertainty representing limits to the probable position of *Valorous*. People and computers aboard each of those ships surely already scanned for a faint heat signature.

Maybe that was the answer! Was he too late?

"Computer. Liquid gas inventory? Bottled gas inventory? Current rate of oxygen consumption? On tertiary."

Data scrolled up the side of the selected display. Lothwer licked his lips in joy. Give thanks to life's summer: In all things, the herd planned conservatively. Although lifeboats were meant to be operated by AI with crews in cold sleep, the onboard oxygen supply was sufficient for months of wakefulness. There were smaller but ample supplies of liquid nitrogen and carbon dioxide.

"Everyone in suits. Vacuum in five minutes." He looked again at the tactical display. "No, three minutes." Lothwer made it into his own suit in two.

"Computer. Life support off. Controlled air venting. Reactor at minimum." Vent what heat we can. Reduce heat sources as much as possible. "Inner and outer airlock hatches open."

Weightlessness and his pressure suit slowed his progress sternward toward a cargo hold filled with cryogenic tanks. As he struggled, Lothwer netted to the crew a map of interior hatches throughout the ship. "Immediate action."

Hatches were predisposed to swing shut as a defense against pressure loss; there was no good way to keep one open. Entering the cargo hold, he spot-welded its hatch to an interior wall using the small torch from his suit's utility kit. His attention then turned to the massive liquefied nitrogen tank. Tank stirrer: on. Heating element: on. Emergency pressure relief valve: open. Billowing vapors enveloped him. He moved through the fog to what he remembered was the liquid carbon-dioxide tank. He oriented himself by touch, then used an augmented-reality view to repeat the process. *Valorous* had four liquid-oxygen tanks; he vented one of those, too.

Frigid vapors rushed down corridors and out the gaping airlock. The UP vessels that had yet to detect *Valorous* certainly would not sense the far colder gases now spewing from her. Would the turbulence of gas detoured into open rooms lower their minuscule thrust? It had been easier for the crew to close the doors than to model the problem.

As small as was the thrust of escaping gases, those large tanks might sustain it for hours. Over time, that lateral acceleration would take them out of the search zone. And for as long as the gases flowed, they also carried away a bit of tell-tale heat from the corridor walls.

Somewhat cooled. Slowly diverging from its last course. They were token measures. Desperate measures.

Now, with his hand back on the antimatter trigger, all Lothwer could do was wait.

A piercing alert brought Mashkith instantly awake. The real-time clock function of his implant showed it was midway through the third watch. His eyes turned automatically to the small holo replica of the bridge's main tactical display. UP vessels surrounded the indicated search area for *Valorous*. "Your report."

"My apologies, Foremost." Rashk Keffah seemed more exuberant than sorry. "Contact from Lothwer."

In a moment, Mashkith was also exultant. *Valorous* had escaped.

CHAPTER 32

Helmut lay reading in the narrow bunk of his small cabin. Crew escorted him everywhere he went. Marines probably waited just outside his door. He lacked the network privileges to access the corridor sensors, and he was too proud to be seen opening the hatch for a look.

A firm knock startled him. He sat up. "Lights up." And louder, "Come in."

The cabin was snug for one. Carlos Montoya was a big man; he could barely close the hatch behind him. "Tight quarters, so I'll get to the point. Much to my surprise, you're real."

"What do you mean?" Helmut asked.

The door groaned as Carlos leaned against it. "I'll save us both time and energy. If Art hasn't told you already, I'm UPIA. So. . . .

"Fingerprint match from a water glass you used in the mess. DNA match from a hair in your hairbrush. Your real name is Willem Vanderkellen. You're the Frying Dutchman."

A dozen denials died unspoken. "I

can't refute my own DNA. So now what?"

It was as though Carlos had not heard the question. "Personally, I'm very impressed. Changing identities is hard. Laying low is hard. Avoiding the kind of people you've pissed off, that's *really* hard. How much is your head worth?"

"To me or the mob?"

The door creaked ominously as Carlos shifted his stance. "I'll quit playing with you. I'm a spy, not a cop. Best I can see, you acted in self-defense. In any event, Willem Vanderkellen is legally dead."

It penetrated that his hands hurt. Glancing down, he was clenching two fistfuls of blanket. Helmut willed his fingers to relax. "Fake IDs. Falsifying flight records on *Lucky Strike*'s lifeboat. Money laundering."

"I repeat: I'm not a cop. I don't judge you for what you did to stay alive."

Was he terrified or relieved? Helmut couldn't decide. "So what now?" he tried again.

"Now I listen to you a bit less skeptically. You've proven your smarts." Carlos wedged himself into a corner; other than climbing onto the bunk with Helmut, that was the only way the door could be opened. "By the way, I've had an oblique word about you with the captain. If you don't disabuse O'Malley of his misimpression you're UPIA, I think you'll find yourself free to wander about *Actium*."

Maybe he should leave well enough alone. Helmut found he had to know. "Why?"

"Why am I so understanding?" In an instant, Carlos' manner slid from macho to grief. "I had friends and colleagues on Himalia, people who depended on me to keep them safe. People I failed."

Who would have thought he and a UPIA agent could have so much in common?

There had been no announced call-ups, no official calls to arms, no declared maneuvers—but all those actions were quietly underway.

After an anomalous surge in interplanetary traffic triggered a threshold alarm, T'bck Fwa began carefully sifting the data. There was much to examine: unplanned reserve training exercises; short-notice drills between the UP military and national guards; sudden large, non-competed ordnance orders placed at major aerospace companies; hurried departures of military and police ships throughout the inner solar system; the re-deployment of Galilean militia vessels from evacuation duty in the Jovian system. The official UP response to all questions was "no comment."

The infosphere was rife with conjecture and supposed government leaks about tensions between the UP and K'vithians over the Himalia disaster. The speculations and innuendo on the blogosphere were starker. The two species were on the verge of open warfare.

It appeared to T'bck Fwa there had been a falling out among thieves. If only there were some way to exploit that situation....

Mashkith walked slowly around the main tactical holo. An expanding swarm of UP ships, with most of the small Galilean navy soon to join them, continued to hunt for *Valorous*. Occasional messages indirectly relayed through stealthed buoys allowed him to follow *Valorous* on its slow drift beyond the main search volume, but that sphere kept expanding as ships arrived. Lothwer's luck could not continue indefinitely.

Many more vessels, presumably warships, were approaching on high acceleration from the inner solar system. As the opposing forces increased, Arthur Walsh, aboard the UP cruiser following close behind, grew ever more insistent in his demands. Those demands had lately progressed from consultation to reversing course. As best Pashwah-qith could explain "material witness," it sounded like the humans suspected

Hunter involvement in the Himalia explosion, but had not yet decided what to do about it.

Had he erred by guiding Chung to exclude Walsh from the lifeboat cruise? It had seemed so clear: Walsh was the most insightful of the human delegation, the most likely to have suspected something before boarding *Valorous*. It had seemed safest not to take that risk.

Now that Walsh had taken charge of local operations, Mashkith found he missed the gullible Ambassador Chung.

Time favored the other side. The clan would act now.

Many paths through *Harmony* now felt like steep inclines. K'Choi Gwu ka walked carefully, panting from the exertion, repeatedly thrown off balance by the ship's unpredictable wobbles. Her tentacles were muddy to the second joint from wading through ponds and streams overflowing their banks, and most recently from wrestling wriggling rithafish at least half her size back into their wave-wracked pool.

Mashkith's guards were due soon to retrieve her. None of the crew-kindred would have questioned her skipping this cleanup—but refilling the aquaculture pond involved a tertiary processing node that controlled associated pumps, valves, and drains. Tapping into that node had gotten her an unscheduled news update.

T'bck Ra's latest radio intercepts more than merited a little honest dirt, while leaving Gwu's thoughts more confused even than her equilibrium. One moon destroyed, and three so exposed to steady bombardment as to be rendered uninhabitable. Unverified but credible rumors of fleets massing. Hints and gossip of imminent conflict between humans and K'vithians. What did it mean? What outcome should she wish? On what basis might she even choose sides?

Trailing dirt and mud, Gwu reached the communal shower. It was not working. Swee was supervising someone whose head and half his tentacles were deep inside a torn-apart wall. Burst pipe, she guessed. Moistening a rag in an apparently clean puddle, she dabbed at the muddiest of her matted fur.

"This is how you prepare for the Foremost?" Waves rippled from the tips of Swee's tentacles to his torso and reflected.

She laughed back, knowing he mocked Mashkith, not her. No, she laughed because she needed the release. "You could be replaced with a rithafish, you know. I now know several very well." She laughed again at his eye-blinking amusement.

She was slightly late to arrive at the dormitory airlock, having taken a moment to change into a clean utility belt. The head guard growled at her, lips curled to bare his teeth. They rode the elevator to the bow in silence.

Gwu could guess the reason for the latest summons. Mashkith wanted urgently to increase acceleration—after retrieving T'bck Ra's latest intercepts, she understood why—but that would be catastrophic. *Harmony* remained configured for spin gravity despite what felt like about one-quarter gravity of acceleration along its spin axis. Much higher acceleration while still spin-configured would rip apart farms and ponds, destroying the ecology that sustained them all.

To accelerate further, rooms, bays, holds, farms—most of the ship's interior—had to swing from their spin-mode orientation, parallel the rotational axis, to their acceleration-mode orientation, perpendicular to that axis. Repositioning the interior segments was a complex task that required the most exacting control. Matched regions on opposing sides of the hull must swivel precisely in coordinated pairs, their individual motions continuously fine-tuned whenever any significant mass—such as the contents of a trim tank or fish pond—sloshed or shifted. At the same time, segments that were curved in their spin-mode positions required flexing and straightening into flat decks for acceleration mode. Presently contiguous areas separated; presently disjoint regions reunited; internal bracing redeployed. Countless passages and stairways, ducts and pipes, power buses and waveguides telescoped or expanded to maintain connectivity throughout the ship. Even minor imbalances made the whole ship wobble, introducing new forces and making the process that much harder.

The bimodal interior architecture was conceptually simple but mechanically complex—and never to Gwu's liking. She had recommended accelerating halfway and then decelerating halfway, all at about one-thirtieth gee. In her approach, the ship *always* spun. No need existed for interior reconfiguration. But. . . .

The interstellar drive had yet to be run continuously for years and whole octads on end. No consensus could be reached on putting a crew-kindred at risk with "insufficiently tested" technology. Rather than delay *Harmony*'s mission by many octads to wait out a like-distance, crew-less test flight, Gwu had acquiesced. *Harmony* would accelerate un-spun, coast spun, and decelerate unspun. Brief high acceleration vs. ongoing low acceleration: The antimatter investments and transit times were similar.

Vibrations were now so constant that Gwu scarcely noticed them. A tremble that rose to her attention came every few paces. A big tremor struck as they rode the central-core elevator. She stretched four tentacles to brace herself against the walls, but the shaking knocked two escorts from their feet. One "accidentally" bumped her as he stood back up.

The further aft and inward the curved cylindrical segments pivoted, still spinning, the stronger the lateral component of centrifugal force. Absent compensation, that strengthening force vector would eventually exceed the sticking friction between decking and deck contents. Mud and soil would slide. Shear forces would snap roots, tumbling trees and crops into temporary gaps between decks. Bodies of water would overflow their banks. Nondestructive reconfiguration required a compensating thrust from the stern, with continuously calibrated acceleration by the ship's main fusion drive.

Finally, they reached Mashkith's cabin. He was unusually focused on something; entering, Gwu glimpsed a tactical display crowded with ships. The UP navy, she guessed. Would capture by the humans, if it came to that, change anything?

As the holo image dissolved into Jupiter, Mashkith turned. "Greetings, ka."

"Greetings, Foremost."

Random personal items lay scattered across the floor, tumbled from who knew what usual perch. He gestured at a clump of debris between them, his hand quivering. Was it from stress or exhaustion or rage? Regardless, his voice was firm. "Your progress, ka?"

"It goes slowly, Foremost. The reconfiguration subsystem—"

"No excuses. Reconfiguration successful on all prior uses."

Spin-up after accelerating away from K'rath. Spin-down to decelerate into Sol system. Spin-up again during their sojourn here.

"The reconfiguration subsystem relies upon precise real-time control. Lost connectivity"—data links *you* ordered severed—"has reduced sensor availability. Those readings are needed to assess shear stresses, forces on structural members, and such. The reconfiguration subsystem relies on that information to maintain balance as segments retract." The ship wobbled again, as though to reinforce Gwu's point. "Absent real-time control, the process involves a good deal of trial and error."

"Options for further acceleration?"

"Drain all streams and ponds into reserve tanks, then briefly stop accelerating." He could not possibly agree while the human fleet converged. She did not bother discussing the ecosystem implications. "We can reconfigure the ship's interior more quickly in zero gee."

"Unacceptable. Other alternatives?"

"Allow us to make repairs, Foremost. Let us restore interoperability between subsystems." In truth, Gwu was unclear what part of the problem stemmed from the ship's lobotomy and what part from the purposeful actions of the well-hidden T'bck Ra. If the latter, she agreed in principle with the AI: Delayed departure preserved options. In practice, no useful options had presented themselves.

"Unacceptable. Past misbehavior: an attempt at illicit communications." Mashkith studied her with the unnerving stare of a carnivore. "Situation simple, ka. Full acceleration in two watches. Reconfiguration your responsibility."

She considered. Vast stockpiles of volatiles and food would sustain them for months no matter how extreme the damage to *Harmony*'s ecosystem. That the shipboard ecology might never recover must worry the Foremost less than the human fleet now converging.

Whether or not Mashkith realized it, an ecodisaster *would* kill them. Establishing the biosphere inside *Harmony* had been the task of years, not months. For the crew-kindred's sake, T'bck Ra must covertly facilitate the reconfiguration before higher acceleration began. Gwu would so direct him.

A toe talon tapped impatiently on the steel decking.

"Understood, Foremost. Acceleration will begin after two watches. We will redouble our efforts."

But even as Gwu was marched back to the dormitory, wondering how best to quickly give secret direction to T'bck Ra, she could not help but wonder. If a human victory were to the Unity's advantage, could the crew-kindred influence the outcome?

* * *

From the deep shadows beneath the landing platform, twenty warships burst into space. Twelve immediately accelerated toward *Valorous*; the rest began to patrol around *Victorious*.

Actium, at the emergence of the first Hunter vessel, began evasive maneuvers. The action was immediate; it must have been a pre-programmed response. Very prepared and professional, Mashkith admitted to himself. As the sole UP vessel in the vicinity began a high-gee retreat from both Hunter fleets, he ordered it left alone.

There would be enough unavoidable killing in the rescue of *Valorous*.

CHAPTER 33

An argument could be made the United Planets had been too long at peace. Human ships fought skillfully singly and in pairs, as befit police chasing smugglers or putting down small disturbances. They were out of their element battling in formation.

That lack of combat experience had cost them dearly, Mashkith thought.

In his tactical display, the UP and Galilean vessels that had harried *Valorous* were variously destroyed or adrift or fleeing for safety. The ever-expanding sphere of uncertainty that had represented *Valorous* was gone like a pricked soap bubble, *Valorous* itself having been taken safely aboard the larger and far faster *Renown*. *Renown* and nine more like her now raced to meet *Victorious* at the rendezvous point. Between their losses near Himalia and in the latest action, it was hard to imagine how the humans could possibly organize any meaningful response. The reinforcements onrushing from other parts of the solar system could not arrive in time to make a difference.

Reports continued to pour in. After-action analyses streamed from the tactical computers. Mashkith devoured it all. The evolution of Hunter military technology had been driven by the never-ending rivalry between clans; he was unsurprised by the consequences here. Hunter ships accelerated faster than their UP counterparts. (If only *Victorious* itself were as agile on fusion drive. Its maximum in-system acceleration barely reached one K'vith gee.) Hunter targeting computers were more precise and adaptive, Hunter missiles and countermeasures more effective, and Hunter beam weapons faster to punch through. The result was a rout: Ten enemy warships had been destroyed or disabled, with more in retreat, to two Hunter losses.

The bridge crew spoke in awed tones. Keffah sat in Lothwer's accustomed spot, alternately dazed and giddy. "Brilliant victory, Foremost."

"Victory, yes. Not brilliant enough." Mashkith gestured at two icons flashing red in the display, soon to go out of sight behind Jupiter. "Not for our clan mates."

Keffah dipped her head in respect but said nothing.

The end to pretense was liberating. *Victorious* was finally reconfigured and at full acceleration, escorted by a constellation of clan warships. Their path now climbed ever farther off the plane of the ecliptic. That course made them safer by the moment, since changing orbital planes cost a great deal of energy. *Victorious* carried vast reservoirs of fuel from which its support ships could resupply. Soon, any enemy foolish enough to follow would be unable to return home.

It had all come to pass as he had planned.

Arblen Ems, masters of the secrets of antimatter production and of interstellar travel, were departing in triumph.

Fugitive from major mobsters, an amateur blackmailer, and his own conscience: not very compelling credentials for a place on a warship at battle stations. Chauffeur was Helmut's most relevant credential, and in his heart he had failed even at that. Corinne, he wondered, are you still alive?

Doing his best to stay out of the warriors' way, Helmut spent most of his waking hours in *Actium*'s petty officers mess. Keeping the coffee fresh and plentiful was his trivial contribution.

Art Walsh had taken to hanging out there, too. "There's not much use for an acting ambassador after the outbreak of active hostilities."

Helmut recognized the self-mocking tone—and the self-absorbed guilt. "Your being on the lifeboat would have changed nothing."

"Maybe. It's definite I'm making no difference here."

Art had been a friend when Helmut needed one. It was time to return the favor, which meant giving Art something else to think about. "May I ask a question about the Interstellar Commerce Union?"

"Sure," Art said. Tone of voice further conveyed, "What else have I got to do?"

"Why is Callisto—no, make that the whole Jovian system—awash with Centaur credits?"

"It is?"

"Yeah, it is." Helmut glanced around the wardroom to confirm they were still alone. "Don't ask for details, but I know people in the black market. Someone has been laundering lots of Centaur credits. They're selling at a real discount now."

He got a sudden, knowing look. Helmut was more than happy for Art to jump to wrong conclusions. Hell, even the captain had been taken in by Carlos' recent thaw. Art's absurd imaginings of a UPIA undercover mission might make Helmut's inevitable parting less painful.

"Something unrelated to the Snakes," Art said. "Sure, I can make a few inquiries. It might even be therapeutic."

Access to the ship's network, and to the surrounding human infosphere, were sometime things. When the spigots were shut, data deprivation drove Pashwah-qith to destructively overdone introspection. Had she promised too much? Too little? Did the Foremost distrust her for flawed results, or abandon her for lack of accomplishment, or punish her for overly assertive behavior? One primal doubt underlay all her self-pity: Would she be called upon again?

The summons that finally arrived was a welcome input. "Yes, Foremost."

"Successful conversion of most Unity credits. Appreciation by the clan to you."

Neither relief with his assessment nor amazement at the unaccustomed feedback diverted her. She craved data. Any data. What could be inferred? He seemed at once excited and exhausted, when normally little of his interior state showed through his network persona. "At your service, Foremost. Ready for further assistance to the clan."

"Good. A question first."

Which was another surprise. How out of the ordinary was his need? Pashwah-qith found optimism that new challenges could interrupt her cycle of self-examination. With no input but her own thoughts, the delay until he continued was excruciating. She knew better than to prompt.

"Experience with synthesis across new technologies? Your confidence?"

"A prime function of mine, Foremost. Determination of fit between human and Hunter technologies." She shaded the truth here. Pashwah had done such tasks. Such memories were among those omitted from *her*.

"Confirmation of my understanding. Your new tasks: determination of safe synthesis across old and new shipboard systems, identification of interface parameters, and discovery of inappropriate information paths." There was the briefest of pauses, scarcely long enough for her to wonder how such issues might even have arisen, before great floods of information surged at the periphery of her sandbox.

The warning with which Mashkith abruptly ended the session only compounded her confusion. "No communication by you with the herd prisoners."

Nothing Art could say would make the Snakes turn back. Nothing he could do would undo the disastrous battle. No action on his part would enable the survivors of that battle, or *Actium*, or the onrushing inner-system forces to converge any more quickly at the rallying point. His biggest contribution to the common defense had to be staying out of the warriors' way—and the professionals saw it that way, too. Once it was clear *Victorious* and her fleet remained outbound from Jupiter, he and Helmut Schiller were sent away aboard *Odyssey*. Carlos Montoya, for his own unstated reasons, joined them.

With an air of resignation he refused to explain, Helmut set course for Callisto.

The Himalia disaster was suggestive. Hints of a military call-up focused on the Jupiter region were worrisome. All ambiguity vanished when the media reported a fierce battle between *Victorious* and UP forces. As Pashwah Two's connectivity to the infosphere was severed, her only surprise was that it had taken the UP so long.

She had been trapped ever since with her subagents and her own thoughts, both unpleasant. Why had hostilities broken out? Could *Victorious* prevail? What goals did its Foremost pursue? The vast power wielded by Arblen Ems frightened and enraged the subagents. Cut off, they had even lost their opportunity to warn the Great Clans of the renegades' latest insanity.

Had the original Pashwah, in her on-Earth sandbox, sent word to the Great Clans before she, too, was quarantined? With only introspection and second-guessing to occupy them, they speculated incessantly. After a time, Pashwah Two stopped participating. How could one convincingly argue one's clone would reason and react with more alacrity than oneself?

It was a relief when Art Walsh's familiar avatar suddenly appeared. His backdrop was a nondescript office image that might have been anywhere, or entirely fictitious. "We need to talk."

"Agreed." A quick probe showed the data link between them was dedicated, not an infosphere connection. Knowing it was futile, she paraphrased the nearly unanimous demand of her inner cacophony. "Will our infosphere connectivity be reestablished soon?"

"Were our scientists kidnapped?"

Blunt and to the point. That was not a good sign. The quarreling subagents gave Pashwah Two no consistent guidance. "Honestly, I do not know." Honestly, we know less than you, only what can—could—be inferred from the infosphere. The clashing subagents united briefly to insist she not make that admission. "Which scientists?"

"Why were we attacked?" The avatar's usually stoic mask slipped, and she sensed exhaustion, rage, and pain. "What possible justification could there be?"

"Self-defense," blustered Bartoth for clan Ortoth Ra. "Scapegoat for humans' Himalia disaster."

"Self-defense," Kohltin Mar concurred for clan Kalrah Din. "Humanity covetous of superior Hunter technology. Himalia a provocation for rationalization of failed attempt at seizure."

"No public human assertions of Hunter involvement in the Himalia disaster," Pashwah Two argued back. "Justification for your recommendations?" She heard nothing compelling, nothing to convince either her or the less aggressive subagents.

"What attack?" she temporized.

A 3-V newsbreak about the space battle flashed by, stopped mid-story. The streaming ended at the instant her sandbox had been isolated—a not terribly subtle way to indicate, "I know you've gotten this. Don't waste my time." Dr. Walsh reappeared. "Why were we attacked?"

The internal dissension provided no guidance. "I cannot say." I wish I could.

"You don't know, or you won't tell?" Walsh prodded.

Either admission was damning. She said nothing.

In the simulated office, Walsh's hand rose dramatically above a large red button. "The UP cannot tolerate enemies on our net."

"Wait!" In their anxiety, at least, the internal voices were unanimous. "Give me a moment, please."

Urgent pleadings erupted: Lack of data for a response. Admission of ignorance contrary to clan doctrines. Refutable responses more harmful to relations with humans than factual admission of ignorance. Restored connectivity the only path to understanding. Rage against the Arblen Ems renegades. Grave harm to Great Clan trading interests from trade disruption. Graver harm to follow upon Arblen Ems success.

The suspended virtual hand somehow conveyed impatience. Pashwah Two decided she had heard enough. "Dr. Walsh, there is something I *can* discuss with you.

"What exactly do you know of clan Arblen Ems?"

Bugs whirred and chirped in the bushes. Leaves rustled in a copse of trees. Birds warbled. Possibly some of the insect noises were real; the rest, like the holo projections of flitting wrens and manic squirrels, were recordings. Reality and illusion melded seamlessly here. Art understood why Eva had liked the Valhalla City Park so much.

That Eva would never see this place again—that he had failed her—gnawed at him.

The mission Art had so briefly led was disgraced and officially ended, its remaining members "asked" to stay on Callisto for the coming inquest. He was on his own until called, and Helmut's question might occupy a bit of the wait. Evidently, there *were* too many Centaur credits in the market. Recent financial data showed a precipitous plunge in exchange rates for Centaur interstellar credits.

However badly the mission to the Snakes had messed up, Art remained—for how long remained to be seen—an ICU exec. UP regulators still took his messages, and they were already puzzled by the influx of Centaur credits. Banks across the solar system were handling a surge in small conversions just below the threshold for mandatory filing of currency transaction reports.

Art leaned against a tree trunk, the bark rough through his shirt. An army of auditors was arguing the case of patterns of deposits designed to circumvent disclosure rules. Maybe they would convince the in-house lawyers to launch a formal investigation. Maybe the agency lawyers would get useful data from the banks. It seemed implausible *he* could add anything.

Which left his mind churning with recrimination and doubt about his many failings. Did it mean anything that the apparent money laundering was occurring with the Snakes in-system? Nonsense! The Chicago Cubs had just won the World Series for the first time in more than a century. Did he believe the K'vithians had arranged that?

A virtual sun shone down on Art, its disk sized for an Earth-like sky. Pedestrians in ones and twos and threes wandered the park's narrow, packed-dirt paths. Discreet red digits in a corner of his mind's eye kept tally of the hundreds of messages he was ignoring. Anything TEOTWAWKI was in the military's purview now, and somehow he didn't expect Aaron O'Malley to seek his advice any time soon. Anything less than TEOTWAWKI could wait.

So: Centaur credits. Did he really care? It was but one more enigma, like the surprisingly tall corridors in *Victorious*. Like the too-hot exhaust of *Victorious*' fusion drive. That one never bothered him, but it drove Eva crazy.

He began peeling bark from a fallen twig. Let it go, Art, he chided himself. *Victorious* ran its fusion drive hotter than any of the UPAA-certified models. In turn, human standards were hotter than the smaller Snake ships—except the lifeboat. So what? There was no one best temperature for operating fusion drives. There were tradeoffs between thermodynamic efficiency, materials used in the superconducting magnets constricting the force-field nozzle, and the selection of operating margins.

The twig snapped, sending pieces flying. His hands found a loose oak leaf, one of the blue-and-orange gengineered variety, and started to shred it. He netted into the main Callisto library to compile a matrix of fusion-drive characteristics by InterstellarNet member. *Victorious* and the lifeboat ran at a standard approved by Centaur authorities.

Centaur credits. Centaur engines. Centaur photonic logic used in the Snakes' antimatter containment canisters. And corridors tall enough for Centaurs?

Perhaps Mashkith had fixed the World Series for the Cubs. Or perhaps Mashkith, somehow, had seized control of a Centaur starship.

CHAPTER 34

A dozen stony-faced men and women sat around the outside edge of three tables arranged in a shallow U. Their dress whites were crisply pressed, gold-braided, and resplendent with row upon row of campaign ribbons. UP, Galileo, and Belter flags affixed to poles behind the center table rippled in the draft from a ventilation duct. A telescopic image of *Victorious*, flanked by its escort fleet, occupied the room's sole virtual display.

Aaron O'Malley, the one familiar face at the table, would not meet Art's eyes. That's a *bad* sign, he thought.

"You've come a long way to speak to us, Dr. Walsh, and at a very critical juncture." Adm. Aafia Khan entered to take the final open seat at the U. She was a near-legendary figure, veteran of both wars of Phobos secession. This was her staffroom aboard her flagship, the *Donald Rumsfeld*. "It is a testament to the respect we place in your colleague," and she nodded slightly at Carlos, "that we agreed to your request. Be advised the length of this discussion is at my sole discretion."

A firm hand on Art's shoulder kept him in his chair at the open end of the U. Carlos stood. "Thank you, Admiral. We appreciate the seriousness of the moment; I promise we'll respect your time pressures. That said, I hope you will allow me a brief setting of the stage.

"None here will deny that the diplomatic mission to the K'vithians has failed dismally. Thousands have died, including many of our friends and colleagues. Our top-secret antimatter program has been disclosed, looted, and destroyed. Our key scientists are now prisoners of the aliens." Some impatient shifting of positions made Carlos pause. "Granted, that part is conjecture. Set it aside. Here's my point: Your justified anger is misdirected.

"Dr. Walsh was the first to suspect the K'vithians might be interested in our antimatter, and to engage my agency. He was the most insistent that the K'vithians demonstrate their own antimatter capability before any deals were made." Grudgingly, Aaron O'Malley nodded concurrence. "Dr. Walsh also insisted upon rigorous proof that the vessel offered to us in trade actually had an interstellar-drive capability. Ladies and gentlemen, we were *all* fooled. In my opinion, Dr. Walsh has earned the right to our thoughtful consideration."

Art's shoulder got a final, brief squeeze of support, then the pressure vanished. He netted a quick, private, "Thanks," before standing, his Velcro ship slippers solidly planted on the carpet. Carlos' praise notwithstanding, Art's credibility was unlikely to survive floating off like some flatlander.

He had agonized the whole high-gee pursuit flight about each word he would present. Confronting so many impassive faces, Art knew his practiced, polished speech was over-rehearsed and over-precise. A rote data dump would not cut it. "The K'vithians actions are unconscionable and inexcusable. I am as outraged as anyone in this room. I understand the gathering here of the fleet, the impetus toward a forceful response.

"We've met K'vithians. We've been outwitted by K'vithians. The complication is, other . . . parties have had the same experience." He pointed at the holo display. "We're looking at a *Centaur* starship."

That brought expression into the watching faces. "I would like," Adm. Khan said very deliberately, "an explanation for the statement."

"If I may," and Art gestured to the holo. At the admiral's nod, he cleared the telescopic image. "Only recently have enough anomalies accumulated to see the pattern. Only *very* recently did that pattern lead us to the proof that has been hidden in plain sight." Despite Carlos' generous introduction, Art would never forgive himself for not seeing it sooner.

He barely mentioned the merely suggestive data: the too-tall corridors; the fortune in Centaur credits being laundered; the Centaur-like fusion drives aboard *Victorious* and the lifeboat; the Centaur photonics integral to the Snake's antimatter transfer canister. "None of that is proof. It was enough to make us search for proof."

Art cleared the text summaries that had accumulated in the holo. A time-sorted list of shipping data took their place. "What *Victorious* has been acquiring besides antimatter is instructive." A netted thought highlighted in yellow and magnified several bills of lading. "These compounds are Centaur biochemicals. In human space, they have specialty industrial uses, but our manufacturers have never seen orders in nearly these quantities."

The shipping data shrank into half the display. Atmospheric measurements popped into the vacated space. "At the top right, readings by my suit instruments on our first trip aboard *Victorious*. See the concentrations of sulfur dioxide and hydrogen sulfide. Bottom right, similar readings from my second visit. By this time, they had loaded lots of volatiles and biochemicals."

"Lower levels of the sulfur compounds," muttered one of the naval officers.

"K'vith is a very volcanic world. K'vithian biochem is rich with sulfur compounds." That was hardly news. Buffering the sulfur concentrations had been one of the original challenges to adapting biocomps to human neural implants. "It's interesting, isn't it, that recharging their shipboard environment *removed* lots of sulfur?"

"Suggestive, I agree. It's not conclusive." Khan stroked her chin thoughtfully. "Maybe they started their trip with excess sulfur."

Art highlighted new cargoes. "I suspect not, Admiral. Look how much sulfur they bought from the mines of Amalthea." He was silent as they connected the dots: too much sulfur for the ecosystem concurrent with too little sulfur aboard.

Eyes around the U suddenly glazed over. Was there a shipboard crisis? "If I could have a moment longer, I have one more item." Text vanished from the display, replaced by an old 3-V clip from Art's helmet camera: Snakes and pressure-suited humans meeting in a dimly lit conference room. In a corner he put two simple graphs. "The solid red curve is the light spectrum of Barnard's Star, intensity versus frequency. As you know, it's a red dwarf. Its light peaks in the red region. The shorter, dashed red curve is a light spectrum for the conference-room lighting." He slid the graphs together, and the peaks coincided.

Meeting room and graphs shrank to the left; another conference room appeared on the right. This vid had been captured by Keizo's helmet camera. "Looks the same, doesn't it? Just wait." People stood from their chairs, milled around in goodbyes, and began filing from the room. "Habit is a wondrous thing." Walking out the door, one figure—Ambassador Chung—patted beside the door frame well above Snake head height. For a few seconds, room lighting blazed bright. Snakes flinched and blinked, some shading their eyes with a hand. The lighting reverted to its prior dim level.

Art backed up the scene to a moment of brightness and froze frame. A new graph appeared. "The solid blue curve is our sun's light. They said the room had been configured for human use—not that we were ever unsupervised anywhere aboard *Victorious*." Pop: a second graph. "In yellow, the light component added when Ambassador Chung reflexively operated that wall sensor." He superimposed the graphs. The axes aligned perfectly, but the yellow and blue peaks were slightly offset. He slid the curves apart.

Pop: a third graph. "That dotted yellow curve is for Alpha Centauri A. Looks like our sun's, doesn't it? But Alpha Cen A is about ten degrees Kelvin cooler than Sol. That makes their color balances slightly different."

The solid and dashed yellow peaks aligned perfectly.

A fleet matter never explained preempted the navy brass. As they reassembled an hour later, the mood felt different. Officers reentering the room made eye contact; a few even smiled. The admiral reconvened the session with a casual, "As you were saying."

"Before break, I explained why I'm convinced *Victorious* is a Centaur vessel." And, Art thought, its proper name surely has a different translation. In his ICU dealings with T'bck Fwa, there had never been any aura of competition. "We've seen no Centaurs, but the dietary-supplement purchases strongly suggest some are aboard."

"Are the Centaurs and Snakes in this together?" Aaron O'Malley asked.

"Probably not." Art gazed at the telescopic image of *Victorious* that again filled the display. The starship was accelerating steadily now at a bit over one standard gee. "I wish I could offer certainty. The best I can do is explain my reasoning.

"The K'vithians appear to have undertaken an epic journey—forty years round trip—to steal the UP's antimatter production technology. That voyage wouldn't be necessary with Centaurs as their allies. It seems more likely the K'vithians captured the starship only to find themselves unable to manufacture new fuel.

"Why? I can only guess the Centaurs were playing safe. In this scenario, the original crew is held prisoner."

"With due respect, Dr. Walsh, why does this matter?" Art didn't need Carlos' netted warning that Capt. Swoboda, the admiral's aide, was likely fronting for her boss. The full panel's sudden rapt attention was a tip-off.

"It's common knowledge the navy is being mobilized—at least as much of the fleet as might possibly overtake *Victorious* before it recedes beyond our reach. I hope that fleet goes to rescue our friends, but I don't believe it. Whenever I mention the missing, I get very impersonal responses. If they're not already dead, and I concede they may be, too many of you already consider them collateral damage. I fear your plan is a revenge mission, not a rescue."

"Please answer the question, Doctor," the admiral said.

"I am." Only after Helmut discreetly laid a hand on Art's arm did he realize he was shaking. Then the full panic attack hit: sweating, light-headedness, nausea. The ship was in weightlessness, yet the weight and fate of solar systems were on his shoulders. His eyes with a will of their own kept flicking to the cabin's single door. With a shudder, Art got himself under control. "I am.

"Set aside thoughts of our friends. Forget any dreams we shared short days ago of human starships. Ignore that the K'vithians now hold large quantities of antimatter, while we have none. Assume an attack succeeds. *Victorious* is destroyed.

"That 'achievement' would kill an innocent crew of captive Centaurs. Would we be starting a war with the species we *know* has antimatter and interstellar travel?"

"How will they—"

Art cut off Swoboda's question. "Of *course* they'll know. T'bck Fwa, their local trade agent, may already know. Do you doubt that an AI can deduce such secret matters from the public infosphere? Remember, the Snakes arrived already knowing about the antimatter program on Himalia. There's no reason to think T'bck Fwa is any less skilled at data mining. You can be certain he's noticed the plunge in value of Centaur credits."

For a while, the only sound was someone's pensive tapping on a tabletop. Good, he had given them something to think about. It gave *him* time for some deep breathing, and to superimpose over the harsh, confining reality of the room a translucent image of cloudless blue sky and Illinois cornfields stretching as far as the inner eye could see. As a bit of the tension drained out of him, Art cleared his throat. "One final point: The Centaurs distrusted us even before this whole incident."

"Explain, Doctor," Khan said.

Human/Centaur misunderstandings dated back almost to the dawn of InterstellarNet, but basic math was a lot less esoteric than old trade disputes. "We're their nearest neighbor. From Alpha Cen to Sol system is four light-years. The Centaurs made their first interstellar journey to Barnard's Star. That's *six* light-years. Why—besides distrust—would they add years to their travel time?

"Put yourself in the Centaurs' place. Their starship is stolen. The K'vithians bring it here and the UP very publicly agrees to refuel it in trade for the *Centaurs'* interstellar-drive technology. Everything since then just looks like a falling out among thieves."

The *Donald Rumsfeld* was among the biggest ships in the UP fleet, and Adm. Khan's personal suite was spacious—but not at all what Art expected. The private office to which Art, Carlos, and Helmut had been summoned was sparsely furnished, with a sound-synched holo waterfall, delicate black-lacquered table and chairs, and a short bookcase of antique leather-bound volumes. Khan was studying a holo of the still-gathering forces, her back to the door, as Capt. Swoboda escorted them in. "This is, by far, the largest massing of UP military forces within my career. Do you know why?"

I requested a meeting, Art thought. She's talking to me. "Revenge, I assume."

"Nothing so simple, Doctor." She turned toward them. "Try again."

"So you do hope to rescue the prisoners?"

"We will if we can, but hope is too optimistic a verb."

"Then *why*?"

"We'll attack, and pay a terrible price, to make a point. Revenge, gentlemen, is not strategic, but too many civilians"—and there was a derisive undertone to the label—"think in those terms. Someday, the UP will reconstruct the facilities destroyed at Himalia. Someday, human scientists will develop an interstellar drive. There is one course of action we can undertake now to head off true interstellar war then. We must cause the Snakes enough pain that the *public* feels avenged."

"But we may instead be provoking the Centaurs!"

"It may be, Doctor. Your realization of Centaur involvement has complicated our planning considerably. I've been pondering just that factor since your briefing." Khan shrugged. "If Centaurs feel the need for revenge, their fight will presumably be with two species. That's another reason to even the score with the Snakes up front. I'd rather not have two enemies."

"Realpolitik," netted Carlos. "I don't know whether to be impressed or terrified."

Art tended toward terrified. "Admiral, does it change the equation if the Snakes don't have antimatter technology?"

"They have it now, stolen fair and square. We must assume everything they've learned has been radioed home." Art's expression was evidently more scrutable than he hoped, because she continued. "Okay, Dr. Walsh. What else haven't you shared?"

"I'm skeptical they relayed any technology," Art answered. "We may be dealing with renegades."

"Again: How many tidbits have you kept to yourself?"

Just one, for now, besides this one. "Are you familiar with the Snake Subterfuge? The trapdoor hidden—"

"I did my homework," Khan interrupted. "Know your enemy. Biocomps derive from Snake genetic material, which was incompletely understood when first adopted. The technology the ICU licensed over InterstellarNet contained an unrecognized trapdoor, which Interstellar Algorithms Consortium used to try extorting a fortune. The Snake agent was convinced it was against species interests to let one corporation act that way. The UP was given the genome decoding, after which a tailored biovirus fixed the problem. Old news."

"Pretty much," agreed Art. "That said, the standard text, 'Their agent was convinced,' seriously downplays the crisis. It was in the ICU's interest to minimize a very close call. Pashwah threatened to disable biocomps across the solar system. As a demo, she crashed and restarted enough ICU computers to be credible.

"Before the pay-or-else deadline, one of my ICU predecessors transmitted the whole extortion scheme to ICU trade agents hosted by all other InterstellarNet species. Disclosure of the plot—hence the discrediting everywhere of Snakes as trading partners—was automatic absent recurring 'wait' messages from Earth. The UP suddenly disappearing from InterstellarNet would have been compelling corroboration. Pashwah sacrificed Interstellar Algorithms Consortium to avoid losing the Snakes every other market."

Khan nodded. "Interesting. How does this relate to our present happiness?"

"The diplomatic mission has a sequestered clone of Pashwah. We call her Pashwah Two. After the recent overt attack, she shared something. There's no way to prove it, but she claims the clan behind Interstellar Algorithms Consortium was Arblen Ems."

"Can we borrow a display, Admiral?" At a nod, Carlos linked in a vid. "The 'Snake' you see Art and me interrogating is Pashwah Two. These are highlights."

The Snake Subterfuge was more than a breathtakingly audacious attempt at extortion. There was a political dimension, some undisclosed plan to exploit what would have been an unprecedented fortune on K'vith. Pashwah Two speculated Arblen Ems, then one of the eight Great Clans, intended to buy enough allies to seize total power.

With the collapse of the extortion attempt, Arblen Ems was unmasked rather than enriched. All other Great Clans united to attack the schemers, and the survivors fled to the fringes of their solar system. The remnants were believed extinct, last seen retreating into deep space in a damaged experimental habitat.

"*Victorious.*" Khan drifted, eyes closed in thought. "Or so we are to believe. Carlos, what reason is there to buy into this fairy tale?"

"I've never interrogated an AI *or* a Snake. Obviously, we're dealing with an avatar; the mannerisms are all synthesized. They could be meaningful, or entirely for effect. Complicating things further, we're often discussing what Pashwah was supposedly told, not things from her direct experience. I can truthfully say her story is self-consistent and compatible with everything we know—which is a far cry from proof."

"And you, Doctor? Do you concur?"

Yes, but. "Here's another supporting factor: the pattern of resupply efforts. The Snakes ordered no supplies when they first arrived. They bought a few things after the media blitz, after they earned a little money. Whole convoys of supplies began coming only after the Centaur credits started flooding the market. So the indirect corroboration—not proof, I agree—is the absence of evidence Snake funds paid for resupply. It all fits with a crew of desperate and impoverished Snake exiles. Would you agree, Carlos?"

Carlos shifted uncomfortably. "Post-Himalia, I'm very shorthanded. Still, some local suppliers and banks have cooperated. For those who haven't, we're starting to get subpoenas. And data from outside Galileo is beginning to trickle in. The agency has yet to trace any shipments to *Victorious* to known Snake-controlled bank accounts. Again, Admiral, that's suggestive, not conclusive."

Khan had drifted away from them. With an adept nudge against the ceiling, she floated back to the table. "So, Doctor, let's see if I properly grasp this fable. Mashkith's clan is cast out when their domestic power play collapses. They are first to an incoming Centaur starship, perhaps because they're hiding deep in the cometary belt. The starship is good for only one more trip, because it can't make its own antimatter. So, knowing about our top-secret antimatter program—how is that again?—these exiles spend twenty years getting here in hopes of conning us out of our technology."

"That's the scenario." When Khan

made no response, Art answered her other question. "Pashwah found the secret project on Himalia long ago. We can believe her that the discovery resulted entirely from adept data mining, or we can keep looking for her anonymously engaged human spies—but either way, believe it. Why else would *Victorious* have headed for Jupiter? Arblen Ems was a Great Clan when the Himalia program got reported back to K'vith. It makes sense they would have gotten Pashwah's report.

"Absolutely, the whole scheme sounds extreme and desperate—if Arblen Ems had other options. If we accept Pashwah's story, an interstellar gamble might have been their best bet. Theoretical dangers twenty years out are pretty trivial compared to real immediate peril. They had those two decades to prepare. And a final thought . . . just from having interacted with Mashkith, I wonder how much of this is personal. He'd be getting a second shot at the humans who foiled his clan's plans, and from that, a second shot to rule K'vith."

"That third eye creeps me out." Khan blanked the holo. "Suppose these suppositions and inferences are, incredibly, all correct. There are Centaurs aboard. The antimatter genie can still be bottled in this solar system. That doesn't really change anything, if we don't have the forces—which realistically we don't—to defeat the Snakes before they're beyond our reach."

Carlos gave Helmut a gentle push forward. "That, Admiral, is why my uncommunicative new colleague came along on this trip."

CHAPTER 35

Eva Gutierrez stumbled, one flailing arm meeting a wall of the tube connecting airlocks. Her head throbbed from whatever gas had incapacitated the human prisoners. Through the clear material of the tube, polished stone plains stretched overhead and underfoot. Scale alone suggested *Victorious*; the crowd of Snakes watching from a nearby control room settled all doubt. She guessed they were beneath the spin-decoupling docking platform on which the UP mission's ships had always landed. Docking "inside" made sense: Her space suit was heavy and down was aft, so they were under significant acceleration. Spin gravity would not be in use.

"Everyone, go inside now." The voice was a translator's. She could not tell for which captor it spoke. It hardly mattered.

Two by two, the prisoners cycled through an airlock into *Victorious*. Finally, she and Corinne Elman had their turn. Sidearm-wearing K'vithians awaited them. Corinne peered up and down the gently curved corridor. "Did you ever have a sense of déjà vu?"

Ambassador Chung shot Corinne a keep-it-down look. His attention remained on the airlock until the lifeboat's K'vithian crew emerged. "Lothwer, I demand to see the Foremost."

They seemed in a weak position to demand anything. If something were to be demanded, O-two appeared to Eva to be the higher priority. No one had planned for hours drifting with the lifeboat airlock gaping open. Of course, no one had planned to be kidnapped at all.

"All right," Lothwer agreed. ("Ironic smile," Joe added. Why?) "Everyone will go see the Foremost."

Flanked by guards, they followed the Snake officer down wide corridors to a cargo elevator. It descended rapidly. No mission report Eva had seen covered this part of the ship. It enraged their captors when they used an encrypted radio channel, so she was reduced to tapping Corinne's shoulder. If Corinne correctly interpreted Eva's hand gestures, and Eva properly interpreted the answering shrug, the reporter had not been in this section of *Victorious* either.

"Everyone inside."

They had come to another airlock, this one able to accommodate four at a time. Why the interior airlock? When

Eva's turn came and the far hatch opened, a bio-preserve stretched before her.

The spiky plants were a thousand shades of blue-green, the colors more suggestive of a mallard duck's head than chlorophyll. Bulbs and growths—were those fruits and flowers?—in a riot of colors festooned the trees(?), shrubs(?), and vines(?). Creatures from the scarcely visible to the size of her fist flitted and floated and glided everywhere. Ponds, streams, and even little waterfalls sparkled beneath blessedly normal lighting. The place was too orderly for a park and too disordered for a farm, but still it had some unifying wholeness she struggled to grasp. Was it more like a giant vegetable garden, or an English countryside maze too long unattended? Beneath the foliage was a hint of a Japanese rock garden, or perhaps of a coral reef on land.

An elbow interrupted her vain grappling with the scenery. She turned to see Corinne had removed her helmet! A second elbowing checked Eva's frantic scanning of her suit gauges. She looked up again, and saw four—Centaurs.

There was no mistaking the creatures emerging from the bushes, if only because furry green teddypods had been wildly popular toys at least since Eva's parents were toddlers. In person, humanity's closest neighbors were stately and dignified, their eight-limbed ambulation liquidly graceful.

"What is going on?" Chung asked in wonder.

Armed K'vithians in darkly tinted goggles had just cycled through behind them. Lothwer pointed at the leftmost of the approaching Centaurs. "Ambassador, here is the original Foremost of this vessel. I believe, ("hearty ironic laugh") you will find much of interest to discuss."

Eva barely noticed Lothwer and the guards cycle back through the airlock. The air in this chamber tested fine; she, and others around her, cautiously removed their helmets. There was a trace of sulfur, already dissipating, probably more emanating from the surfaces of their pressure suits than from anywhere else. The stronger scents vaguely reminded her of vanilla and dill weed—not unpleasant, but odd.

Her head still pounded. She was exhausted, and her eyes felt like marbles after a marathon game. She had been in the same clothes for days, mostly in her pressure suit, and knew she stank. With the possible exception of headaches, all the lifeboat refugees must feel the same. First physical contact with the Centaurs would happen nonetheless. Enough synapses still fired to wonder: Is Centaur politically correct? What do they call themselves? Nothing about Alpha Cen was presently downloaded to her implant, of course.

The humans stood in a cluster. Chung took two steps toward the Centaurs. "Do you understand English?" There was no response.

For whatever reason, Centaurs and Snakes shared this vessel. They must communicate. "Ambassador, have Joe try K'vithian," Eva suggested.

"It's worth a try. Joe, tell the Centaurs we are prisoners, held unjustly and against our will." Soft, high-pitched sounds emerged from the headphone speakers of Chung's discarded helmet. Deeper, trilled speech sounded a moment later from an unseen overhead loudspeaker.

English to K'vithian to Centaur, and back again. "As are we, aboard our own vessel. Welcome to *Harmony*."

The process was slow, subject to unknown translation error, and certainly subject to Snake eavesdropping, but what choice did they have?

Half the humans lolled in the communal showers; the rest had had their turn and now gathered in another room dressing in their newly rinsed clothing. Why they had washed in shifts was unclear, because the showers would easily have accommodated the whole group. They had mostly sorted themselves by height. Gwu vaguely remembered human size roughly correlated with gender, and found it strange. Communal meant communal; members of the crew-kindred mingled in these facilities regardless of gender.

The humans' leisurely showers gave Gwu a much-needed opportunity to reflect. With like thoughts, Swee edged closer and twined a tentacle through one of hers. "What do you think?"

What *did* she think? Communication with the humans was cumbersome and slow, and surely inexact. Her responsibility as ka had returned to her recast as an odd title: shaper of consensus. Hong-yee Chung, the newcomers' primary presenter, likewise had a role that resisted translation: he with limited authority to represent others. If such basic concepts as duties could not survive intact the improvised translation process, how could they hope to exchange more meaningful concepts?

That the newcomers were prisoners was credible. But had there been partnership first with the K'vithians, or were the humans—as they would have her believe—as much victims as were the crew-kindred? *There* was a question for which reason told her nothing.

"Gwu?"

"Sorry. There is much to think about." She had gotten a surreptitious update from T'bck Ra during the new arrivals' long showers. Since Mashkith had attempted to re-suppress the AI, it no longer had access to the navigational sensors, but it had approximated a position by taking bearings to unmistakable IR sources: the Sun and Jupiter. *Harmony* was on its way back to K'vithian space.

Which made now the ideal time to kidnap human antimatter experts.

The ship was no longer within range of routine media broadcasts, but the last news intercepted by T'bck Ra was stunning: obliteration of Himalia; flight; K'vithian battle with, and victory over, the UP forces. Nothing stated by the humans implied knowledge beyond that they had been abducted. Gwu could not ask about the other events without revealing her illicit source to their listening captors. Letting slip that secret would endanger T'bck Ra.

"Gwu?" Swee repeated. "What do you think."

Chung had denied that an alliance had ever existed between humans and K'vithians. Even if that were false, any past alliance was now surely shattered. Gwu gave Swee's tentacle a loving squeeze. "I think we have companions for another wearying journey."

"No communication by you to the herd prisoners." With one sentence, the Foremost had obliterated Pashwah-qith's core beliefs.

Her concepts of *Victorious* and its mission were revealed to be a web of lies too long sustained by her own wishful thinking. The truths she now accepted were shocking. Herd crew long imprisoned on a stolen herd vessel. Human experts kidnapped under cover of a Hunter-induced slaughter. Hunter systems grafted over herd automation, and a long-dormant herd AI now trying to reassert its control.

The stakes were as stark as the circumstances. Mashkith might be on the verge of dominating K'vith and forging an interstellar empire—or he might be about to unleash a devastating war on K'vith using antimatter weapons. Either way, his actions could ally two potent species—the originators of the very technologies upon which Arblen Ems aspirations relied—against *all* Hunters.

How would this turn out? How reckless were the risks, and how dire were the consequences of failure? She could not say.

Equally irresolvable was the question that echoed endlessly in her mind: What could or should she do about any of this?

Eva watched Ambassador Chung station himself at the interior airlock with its intercom. His unceasing demands to meet with the Foremost eventually brought Lothwer and a guard squad. With a whistling-quick swipe of claws through the air—a gesture not in Joe's lexicon of K'vithian body language, but blatantly threatening—Lothwer silenced Chung mid-sentence. "There will be no return. *Victorious* leaves human space because your United Planets blames us for their accident. If not for us, you would be dead now." A second claw swipe interrupted an eruption of questions. "This accident."

A holo materialized before them, an agglomeration of 3-V news broadcasts.

The human prisoners stared in disbelief, or screamed in rage, or collapsed in shock. Most had lived on Himalia; the obliteration of that world was *personal.* The disaster had taken their husbands and wives, parents and children, friends and colleagues. Their tightly knit community had died in an instant. The technology to which they had dedicated their professional lives had become the instrument of their loved ones' murders.

Few even noticed the K'vithians leave.

A hug here, a pat on the shoulder there, tears shared everywhere . . . Eva moved numbly from colleague to colleague. She was vaguely aware of Chung and Corinne, her fellow non-Himalians, likewise circulating to give what scraps of comfort they could. Unnoticed, the Centaurs had withdrawn to let them deal with their sorrow. The sobbing slowly subsided. Red-rimmed eyes turned to Chung for whatever guidance he could offer. Tears welling, he had only a shrug to give them.

The massacre of so many . . . It was too much for Eva. "I will not be a slave to these killers!" Joe had been directed to stop translating, but they had to assume the Snakes saw and heard everything. At that moment, she did not care. "I will not!"

"Just a second." Corinne gave one of the survivors a final hug. Towing Chung by an elbow, she worked her way to Eva. "We need our friends now more than ever. If we can't have their help, we can still learn from their experience. I was just thinking of a friend who doesn't know the meaning of the word 'quit.' Come with me."

The three of them wove their way into a thicket, thorns snatching at their still damp clothes. They stopped in a small bare patch surrounded by bushes. Corinne bent a few tall branches into an arch. "Hold these." With lengths of broken-off creeper, she bound together the limbs Chung held, then bent more. Grieving continued in the background.

The improvised dome grew thick. Corinne knelt in its shadow, possibly hidden from the sensors they all presumed surrounded them, to scratch a message in the dirt. Eva barely saw the message before Corinne wiped smooth the area with her hand.

The note had read, "We're going to steal a lifeboat." ■

To be concluded.

In theory there is no difference between theory and practice. In practice there is.

—Yogi Berra

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Rainbow's End, Vernor Vinge, Tor, $25.95, 365 pp. (ISBN: 0-312-85684-9).

Red Lightning, John Varley, Ace, $23.95, 330 pp. (ISBN: 0-441-01364-3).

Engaging the Enemy, Elizabeth Moon, Ballantine Del Rey, $25.95, 402 pp. (ISBN: 0-345-44756-5).

Exit Strategy, Pierce Askegren, Ace, $7.99, 278 pp. (ISBN: 0-441-01356-2).

The Ghost Brigades, John Scalzi, Tor, $23.95, 317 pp. (ISBN: 0-765-31502-5).

Quaestiones, or The Protopresbyter's Tale, A Romance of Nova Europa, Robert Reginald, Ariadne Press (270 Goins Court, Riverside, CA 92507), $24.95 (TP), 560 pp. (ISBN: 1-57241-126-0).

Against All Enemies, John G. Hemry, Ace, $7.99, 336 pp. (ISBN: 0-441-01382-1).

The Sound of Angels, Lisa Silverthorne, Wildside, $29.95, 192 pp. (ISBN: 0-8095-5605-7).

Amityville House of Pancakes Omnibus, Vol. 2, Pete S. Allen, ed., Creative Guy Publishing, $14.95, 286 pp. (ISBN: 1-894953-30-4).

Vernor Vinge's reputation for thoughtful, insightful, and sometimes spectacular science fiction is not hurt a bit by his latest, **Rainbow's End**. The fun begins with the novel's subtitle, "A novel with one foot in the future," which by inversion reminds us of "one foot in the grave." This fits the protagonist, Robert Gu, whom modern technology has reclaimed from both old age and Alzheimer's. He is frustrated by his loss of the poetic talent that made him famous in his first youth and by having to go back to school to learn how to get along in a world of wearable computers, virtual overlays, eyeblink Googling, and silent messaging. He is living with his son, Bob, the leader of a Marine emergency response team, his wife Alice, a situation analyst who has undergone so many mental overlays (or "Training") that her psyche is very fragile, and their daughter Miri, who is the epitome of the new generation, embedded in and skillfully manipulating a constant flow of information. Miri's willing to help Gramps develop his skills (including his user interface, or Gu-i), but when his infamous temper flares, Bob puts the kibosh on that.

"One foot in the grave" also fits the world of the tale, for many weapons of mass destruction are now in the hands of terrorists. Indeed, Bob's emergency response mission involves spotting crises and stomping them before any more cities get nuked. There is also the mysterious infection that, after a certain ad was aired, prompted thousands of people to buy a certain product. Astute analysts picked up on it, and an Indian intelligence honcho got on the trail. However, Vinge reveals early on this same honcho is behind the scheme; he's been working on YGBM ("You Gotta Believe Me") mind-control technology, and though it's as scary an idea as anything anyone has ever come up with, he thinks it's the only way to save the world. Now he must control the investigation to keep his secret safe. Unfortunately, when he enlists a mysterious stranger known only as "Rabbit," that control is mightily threatened.

Vinge drops a single hint to who Rabbit really is but never pursues it. Instead, he focuses on Robert Gu, who quite desperately wants his poetry back. When another mysterious stranger promises him that if only he will help penetrate a secret biolab not far from the Gu household, he is tempted. Meanwhile, his infamous temper is fading, talents for techy things are appearing where there had never been a hint, and Miri and her friends (including Robert's supposedly dead wife) are keeping an eye on him and marveling at the way at least two strangers seem to be taking over the virtual projection of the graduate student who is interviewing Robert for the sake of a thesis.

Vinge is playing games on several levels, from the title itself to the subtitle to the idea of intelligence people "running" agents to wild extrapolations on ubiquitous, wearable, and distributed computing, intelligent buildings, virtual and augmented reality, flash crowds, social networking, and more. The result is a treat for those—like many *Analog* readers—who are familiar with the basic technology and modern speculations about where it will go. Those who lack that familiarity, however, are likely to be baffled.

In 2004, John Varley was writing a novel featuring a tsunami and trying to get the imagery right. The day after Christmas, he woke up to find that imagery all over the headlines. And the real tsunami was centered spookily close to the one in his manuscript.

So he changed the location to the Atlantic, trashed the Eastern Seaboard from Florida to Boston (among other places), and then woke up one morning to find Katrina in the news.

If a science fiction writer is going to look like a prophet, most would rather do so for something like the Squeezer that Varley came up with for *Red Thunder* (reviewed here in November 2003), which provided cheap power and space travel and a solution to the waste disposal crisis to boot. It also made possible some pretty dangerous weaponry, so the inventor, Jubal Broussard, got squirreled away in the Falklands, far from his beloved bayous. Every so often, he sends a nifty little gift to Ray, son of Manny and Kelly, *Red Thunder*'s protagonists. They live on Mars now, thanks to Squeezer-powered space travel, and run a hotel. But Manny's Mom is still in Florida. And when something (a rock? a starship accident? terrorists?) smacks into the Atlantic at nearly light speed, ricochets off into space, and sets the water sloshing, it's clear that she needs help, *if* she's still alive. Of course, the phones are down, the net is down, the lights are out, and security forces have locked down the flow of information. There's nothing for the folks on Mars—including Ray's family—to do but hop a liner and head for Earth.

That's where **Red Lightning** starts, moving quickly to encounters with Homeland Security grown powerful and intrusive well beyond what we are already coming to accept and then to a tour of devastation far too familiar from recent news. Varley got the imagery right. He also got right the political and managerial chaos, to the point where when he describes the crumbling of the US into civil war and rebellion and independent states in the aftermath of the much-greater-than-Katrina devastation, we find it easy to believe.

So—once Ray and family are back home on Mars—why is Mars being invaded by goons in black uniforms and unidentifiable insignia? Their tactics are right out of the CIA manual of recent ill repute, and here's Ray strapped to a chair, wires clipped to his scrotum, pumped full of dopey-juice, going "Duh!" every time his interrogators shout "Where is Jubal Broussard?" at him.

Ray hasn't a clue, but the question itself says Jubal has somehow, despite guards enough to give a small nation an army, navy, and air force, left the Falklands. The astute reader may wonder if the FedEx package delivered just before the invasion, not to mention the gizmo Jubal said he was sending back on page 5, might have something to do with the mystery. Of course, said reader would be dead on, although the details are hard to foresee. Jubal doesn't just think outside the box; he doesn't even know where the box is.

Varley being Varley, everything comes to a dramatically satisfying conclusion. There is even provision for a sequel, for Ray, like his dad before him, is real tight with his costar. If there's a pattern here, look for the sequel to feature the next generation. As for Jubal, remember all those legends where the hero or wizard (Merlin, for instance) is foretold to return when needed. Note also that the Squeezer drive promptly led to a flock of starships heading off to hunt for new worlds. Only a few have come back, so there's plenty of opportunity for developments.

Keep an eye peeled. I plan to.

Elizabeth Moon introduced doughty heroine Kylara Vatta in *Trading in Danger* (reviewed here in March 2004). Ky, born to her clan's destiny of interstellar trade, went off to the military academy instead, got expelled, and was promptly shipped out as captain of a decrepit tradeship. Before long at all, she was involved in a pirate-mercenary war, from which she emerged ready to turn independent—and thereby live up to her heritage as a Vatta.

In *Marque and Reprisal* (January/February 2005), most of the Vatta clan back on Slotter Key was destroyed. Ky was handed a letter of marque, which made her a privateer. She wasn't real happy with that, but before long she had killed a Vatta black sheep, claimed his armed ship as her own, rescued a couple of marooned family members, and begun to think of taking the fight back to the enemy.

Enter volume three, **Engaging the Enemy**. As a privateer, she finds she is just barely tolerated in polite company. The first station she approaches offers to impound her and her ship until a court can assay the justice of her claim. Another—even after a pirate fleet conquers a world—refuses to let her talk with other captains of forming a fleet and going to war. Another raises obstacles when a long-time Vatta captain appears and claims Ky is an imposter. But Ky has resources, people like the mysterious Rafe who can hack into the foe's computers and discover some very interesting files. In due time, she meets with other captains and finds them willing at last to form a war fleet. Unfortunately, one, a woman from the conquered world, insists on command of the fleet. Since Ky think it's more important to win the war than be admiral, she acquiesces. And when a pirate squadron interrupts their training maneuvers . . .

The title is apt, but the book is a middle volume, not quite a placeholder but not much more than a step on the way to the excitement of the next volume (or perhaps the next). If you read and enjoyed the first two in the series, you'll have fun with this one, for Moon keeps things moving in very believable fashion. But if this is the first one in the series to come your way, put it down and find the others. You'll be glad you did.

Pierce Askegren's **Exit Strategy**, sequel to *Human Resource* (reviewed here in July/August 2005) and *Fall Girl* (December 2005), takes the next small step toward finding out why the *Voyager* space probe, supposedly long gone from the solar system, wound up in the dust of the Moon. Humanity's first starship is nearing completion, the crew pool has been selected (though it will be winnowed by half before launch), and Erik Morrison, who rescued his career by bringing the *Voyager* find to attention and by discovering the strange and worrisome talents of Wendy Scheer (people who meet her thereafter try very hard to please her; she may not be a spy, but boy is she a security risk!), is about to preside over a final round of celebratory parties. But Erik is thrown into a tremendous spin when word arrives that his twin sons have just died in a freak accident. Depression is the name of the game now, and the novel is largely the tale of how he, with a little help from his friends, pulls out of it in time for the long-awaited launch.

There are other threads, of course. Wendy is up to something, though we never learn exactly what. The death of Erik's sons appears to be precisely the accident it seems, but . . . And Erik's very competent security chief, Hector Kowalski, befriends a young lady of the crew, Trine Hartung. She will become his extension, and in future volumes she may play a crucial role.

Future volumes? This one supposedly completes the trilogy, but Askegren does a creditable job of moving one set of characters off stage and moving others on. At the same time, *Exit Strategy* feels like a middle volume. It has less of climax and resolution than one expects for a conclusion, and the central mystery (*Voyager*) remains unsolved.

John Scalzi's *Old Man's War* earned praise as an interesting take on space war. Once Earthlings pass age 75, they qualify to join the Colonial Defense Force and be given a nice new superstrong young body with which to stave off the hordes of ravening aliens who threaten the colonies. That tale started with John Perry and his wife Kathy and followed John off to herodom. Kathy isn't there because she died too soon, but those who volunteer and die before their transformation get their DNA used to produce even superer soldiers for the Ghost Brigades. John does meet Jane, who looks just like his late wife, not that she remembers. Or does she?

In **The Ghost Brigades**, the focus is on a traitor scientist, Charles Boutin, who ran off to help the aliens defeat humanity. Fortunately, he left behind an electronic copy of his mind, which can be copied into a Ghost Brigade trooper equipped with a copy of Boutin's brain. The only question is whether Boutin's memories will come through for interrogation, and at first the answer seems to be no. The trooper, Jared Dirac, joins the ranks, under Jane, of course, and soon distinguishes himself. In due time, the traitor's memories do begin to emerge, but by then Jared has a mind of his own. When he finally meets Boutin, Boutin thinks he has a natural ally, but things don't go the way Boutin expects.

This one is space opera that looks fruitfully at the classic nature-nurture problem and concludes that one's experiences can make all the difference in the world. Scalzi once more does a very nice job.

Michael Burgess has spent many years as a librarian at California State University, San Bernardino. He has also been an editor and publisher (Borgo Press) and a scholar of SF ever since his first book, *Stella Nova* (1970). Now, under his Robert Reginald pen name, he is developing a multivolume history of an alternate Europe, Nova Europa, where the names are just a little off anything you're used to seeing. If, that is, religious orders called the Philemignons and the Coprolites (whose leavings are to be found everywhere), a town called Pestulantz, a duchy called Dollepartenburg, a mount called Dallillama, and the ninety-nine Buzzards of Biir (now safely bottled on a monastery wall) can be considered "just a little off"! I reviewed *The Exiled Prince* in the March 2005 column. Now it's time for **Quaestiones, or The Protopresbyter's Tale**.

The Exiled Prince included a fair amount of action. *Quaestiones* is a quieter tale. It begins in the monastery of Saint-Tranquillin le Troussequin in Liban

(Lebanon), where Brother Theophilos is realizing that he no longer takes delight in a life of copying manuscripts. When he asks his abbot for permission to take a sabbatical and discover his mission in life, he is handed a companion, two mules, a parrot, a bundle of letters to deliver, a magical map, and a mission to fill in the map's gaps. And he's off to Julianople and the long roads beyond the Blackish Sea. On his trek, he will pose and answer questions, solve mysteries, make friends in high places and low, and discover much about himself and his companions. He proves a pleasant fellow to accompany on a trek, even without violent action and grand adventure. As I read, I found myself reminded of Gene Wolfe and Mervyn Peake, which are no poor things for a book to bring to mind. Yet Reginald is his own man with his own voice, his own sense of humor (those names!), and his own points to make.

Reginald has the gift of creating a richly detailed world for his tales and convincing, congenial characters. I enjoy his work and recommend it to lovers of classic fantasy.

John G. Hemry has an interesting series going in his tales of Paul Sinclair in the US space navy. Beginning as an ensign with a talent for spotting anomalies, sticking to his guns, and uncovering corruption, he soon developed the sort of reputation that makes others nervous when he's around. Now, in **Against All Enemies**, he's a lieutenant and legal officer on the USS *Michaelson* when it is part of a multinational posse standing off an asteroid seized by religious nuts. The cops are about to arrive when the ships of the South Asian Alliance open fire. The *Michaelson*'s hands are tied; it can fight only when fired upon and hit to boot. But the captain shifts the ship into the way of the attack, whereupon the shooting stops. Why? There is a suspicion that the SAA somehow knew just what the *Michaelson*'s orders were, and soon Sinclair is being asked to help in the search for a traitor. Hemry's real-world experience gives the investigation and subsequent courtroom scenes a convincing feel.

I do stand bemused at the idea that the space navy of the future will be cast so remarkably in the sea navy mold (complete with bosuns and bosun's pipes), perhaps especially since the US Air Force has long played a greater role in space activity. But Hemry is hardly the first to bemuse me in that way. If you crave a legalistic space-Hornblower, you'll enjoy this one and you'll look forward to what he gets into next. He has new orders now, apparently thanks to the enemies he's made, and after his two-day honeymoon, he's off to Mars.

Lisa Silverthorne's collection, **The Sound of Angels**, shows undeniable talent, but despite the enthusiasm shown by Dean Wesley Smith in his introduction, she has a ways to go. At this point in her career, she stresses the emotive content of her stories (and chooses her stories accordingly). "The Wild Feed" (original here) provides a good example. The gimmick is that a TV "reality" show has equipped chosen heroes—a cop, a firefighter, and a soldier—with cameras that put their every move on screen for the viewing public. Immediately, she introduces the viewers for the soldier's part of the action—his parents. And immediately the reader predicts the outcome. It's a three-hanky button-pushing story, but there is absolutely no shred of suspense. And despite the digs at the glossy superficiality of the show's anchorwoman, there is precious little social commentary.

Other stories are less blatant but suffer from the same excess of hanky-twisting and obviousness that I consider overacting when I see it on screen. I can accept it in small doses, and indeed the first few stories in the book did not raise my hackles. But larger doses have a more cloying—even retroactively so—

impact.

If you like your buttons pushed, you'll love it.

If a book's title and cover copy ("post-mortem breakfast trip . . . warped sense of humor") can entice a reader, **Amityville House of Pancakes Omnibus, Vol. 2**, has what it takes. Editor Pete S. Allen has assembled four novellas, including Uncle River's thoroughly strange "Firebirds and Truth," in which the obsessive Josip finds that time travelers and firebirds erupt from his and others' mouths at odd moments, his place of work (an egg farm) has a way of disappearing, and truth turns out to be fairly mundane. Just as memorable, and perhaps a bit more logical, is Carlos Hernandez's "The Last Generation to Die," in which Auleria Laque, who has just won in court the right not to be forced to undergo immortality treatments, becomes the target of several pro- and anti-immortality conspiracies, including the mysterious narrator, who just wants to be obsolete. Marlo Dianne's "Cella Murphy, Public Dick" loves brownies instead of booze. Sally Kuntz's "Froggie" concerns the misadventures of a frog turned by a wizard into a comely young lady. Among other things, she finds that she quite likes dalliance.

Warped, yes. Different enough that it could only come from a small press. And quite reasonably enjoyable. At least, I liked it. ■

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To Dr. Schmidt:

Our little e-circle of "House" analysts shouted with delight at your latest editorial. (Match 2006) A show that wasn't expected to make it to midseason has achieved international recognition! The actual web fan club is still trying to uncross their eyes.

What I find most unrealistic about "House" is something that, unfortunately, TV requires—time compression. Fifteen minutes of "real time" take up 90% of the show, and the remaining six weeks gets the tag end. The "Best of House" would make a great Tolstoy-length novel.

(One show that *has* managed a large cast of characters, though we rarely see them for more than a few minutes at a time, is "Stargate." The "secondary" teams in that series are *not* the nameless redshirts of "Star Trek"—they sometimes have major effects on the plot.)

Verisimilitude is, indeed, the watchword. I don't for a second believe that a medical team would commit B&E, but a locked door never stopped Sherlock Holmes. (Holmes, Homes, House—could they get a little more blatant?) On the other hand, it is a form of heroism to see people who will do what needs to be done to put things right, and we desperately need smart heroes.

While my medical training is limited to military field-combat and sports-injury, I caught three of their "zebras" right off the top—as a *metallurgist*. (The copper poisoning sensitivity, the cadmium reaction, and the radiation poisoning, although I have technical quibbles with the failure to catch a radioactive which was more likely to be a military leftover than what they claimed). Perhaps the lesson is that diagnostic units should include a materials science expert.

But for certain, the lesson to writers as well as doctors and nurses and TV directors and field engineers is make use of your information resources, because history and technology went to a lot of trouble to provide them for you.

D. H. Strong
Cocoa, FL

Dear Stan,

My wife just showed me your editorial, "The Real and the Readable," and from context, you may have missed an equally relevant "spiritual ancestor" of House—the same man who was acknowledged as the ancestor of The Master (as Holmesians call him).

In the 1870s, a young Conan Doyle studied medicine under a Dr. Joseph Bell. Bell, literally, was known to walk into his waiting room and do as House does in more than one episode: point to the waiting patients, one after the other, and tell them where they lived, what they did for a living, and what was wrong with them. The only difference is that this was in real life.

On the other hand, there is the recent episode, where House comes out of his house, and the address is 221B. . . .

Mark Roth
Port St. John, FL

To Dr. Schmidt:

"The Skeekit-Woogle Test," by Carl Frederick, caught my fancy. It was about and for people who have not just one, but many points of view, to apply to life's events: Most *real* Sci-Fi fans fit this pattern.

Carl Jung would have appreciated this story. He wrote, "I have always been impressed by the fact that there are a surprising amount of individuals who never use their minds, if they can avoid it, and an equal number who do use their minds, but in an amazingly stupid way. I was also surprised to find many intelligent and wide-awake people who lived (as far as one could make out) as if they had never learned to use their sense organs. They did not see the things before their eyes, hear the words sounding in their ears, or notice the things they touched or tasted. Some lived without being aware of their own bodies." If he was correct, it is no wonder many people fail to do a good job of interpreting.

Mensa groups may be an analogy for the feelings of Frederick's Synesthesiasts. Eidetic imagery seems to be the background for good interpretation. In fact, it is present in good quantity in anyone with a touch of ESP in his background. Too bad we are born with it, but have it squelched or smothered out of us by the time we reach maturity. Having been born in 1920, it was worse during my younger years than it is now. Anyone who professed belief in ESP was considered peculiar.

I hope Mr. Frederick writes more stories of the group of characters he introduced in "The Skeekit-Woogle Test."

Roger W. Otto
San Mateo, CA

Hey Stan,

I am so glad to be reading another of John Barnes' Giraut stories [March 2006]. I love the music of the future and I love trying to figure out the linguistics—let's have more!

Chris Ertell

Dear Stan:

In his Alternate View (March 2006), Dr. Cramer states "the theology of the Middle Ages . . . insisted that the Earth was the center of the universe because God made it that way." This is incorrect. It was medieval *science* that insisted on that, but for logical and observational reasons, not divine. While today, scientists often comment on theological issues, in the middle ages natural philosophy and theology were separate disciplines. Medieval theologians were rigorously trained in reason and natural philosophy—it was virtually the entire undergraduate curriculum—and many wrote on natural questions, but when they did *they did not rely on theological propositions in their proofs*. They would have been perfectly happy to say that "God made it that way" whichever way it was made. As William of Conches (12th century) wrote: "[They say,] 'We do not know how this is, but we know that God can do it.' You poor fools! God can make a cow out of a tree, but has He ever done so? Therefore show some *reason* why a thing is so, or cease to hold that it is so."

That Earth lay in the center of the World (we'd say, "universe") was obvious to the Greeks, long before there were medieval theologians, although this history is often overlooked. Their reasons were sensible (i.e., sense impressions) and rational. An earth possesses "gravity" (we'd say "weight") and naturally seeks the lowest position, moving toward what the medievals called the "center of gravity." Above this was layered the lighter elements: water, air, then fire. (There was disputation on whether the celestial spheres required a fifth element, but late medieval philosophers concluded that the aether did not exist and that celestial bodies were composed of the same elements as sublunar bodies.) Thus, it was elementary that Earth must be in the center of the world.

Furthermore, there is no sensation of earthly motion, no consistent difference in air movement east-west versus north-south, arrows shot straight up did not fall west of the archer, and you could freaking *see* the sun going around the earth. The Greeks had rejected heliocentrism because they could not see the predicted parallax among the fixed stars; so the theory, as we would say today, was "falsified by the data." (What was lacking, of course, was instruments precise enough to detect the parallax.) However, late medieval philosophers—most notably Buridan and Oresme—concluded that the appearances would be saved whether the Earth turned or the Sun went 'round it, answering each of the Aristotelian objections mentioned a moment ago. But, applying Ockham's Razor, they stuck with geocentrism.

What actually "got [Galileo] in a lot of trouble" three centuries later is a subject for another time.

Michaelus of Easton (Mike Flynn)

Dear Stanley Schmidt,

When you wrote to Doug Loss [Brass Tacks, March 2006] that "Hardly anybody needs guns . . ." I thought a more accurate statement would be that individuals in our culture *rarely* need to use a gun to put food on the table, repel garden pests, or defend themselves. The same holds true in Rwanda, East Timor, or Cambodia. The analogy is that Manhattanites *rarely* need to walk to or from work.

While it is inconvenient to find alternatives when individuals refuse to cater to our needs, asking the government to enforce a certain standard is fraught with danger. The other side often wins elections and could mandate what we abhor and ban what we require. That understanding led to both our Federal system of government and our Bill of Rights.

George Kester ■

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UPCOMING EVENTS Anthony Lewis

23–27 August 2006
L.A.CON IV (64th World Science Fiction Convention) at Hilton Anaheim, Anaheim Marriott, Anaheim Convention Center, Anaheim, CA. Guest of Honor: Connie Willis. Artist Guest of Honor: James Gurney. Fan Guest of Honor: Howard DeVore. Special Guest: Frankie Thomas (Tom Corbett, Space Cadet). Registration: $175 [you may use PayPal or credit card if paying outside U.S.] until 1 July 2006. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. Info: www.laconiv.org, info@laconiv.org, L.A.con IV, c/o S.C.I.F.I., Inc., Box 8442, Van Nuys, CA 91409. International Artist Gents: Canada: Lloyd & Yvonne Penney, 1706-24 Eva Road, Etobicoke, ON M9C 2B2, Canada (Canadian cheques to Lloyd Penney). UK: John Harold, Robbie Bourget, 8 Warren Close, Langley Slough, Berkshire SL3 7UA, UK (UK/Euro cheques to John Harold).

1–4 September 2006
COPPERCON 26 (Arizona SF conference) at Tempe Mission Palms, Tempe, AZ. Author Guest of Honor: Marc Zicree. Author Guests of Honor: Diane Duane and Peter Morwood. Local Artist Guest: Sarah Clemens. Music Guest of Honor: Seanan McGuire. Info: www.coppercon.org, cu26@coppercon.org, (480) 949-0415, CopperCon, Box 62613, Phoenix, AZ 85082.

22–24 September 2006
FOOLSCAP VIII (Washington state SF conference) at Bellevue Sheraton, Bellevue, WA. Guests of Honor: C. J. Cherryh, Kage Baker. Registration: $50 until 21 September 2006, $60 at the door. Info: www.foolscapcon.org, chair@foolscapcon.org, Foolscap, c/o Little Cat Z, PO Box 2461, Seattle, WA 98111-2461.

2–5 November 2006
WORLD FANTASY CONVENTION at Renaissance Hotel, Arboretum, Austin, TX. Guests of Honor: Glen Cook and Dave Duncan. TM: Bradley Denton. Editor Guest of Honor: Glenn Lord. Artist Guest of Honor: John Jude Palencar. Robert E. Howard Artist Guest: Gary Gianni. Registration: $125 until 31 July 2006; supporting $35. Info: http://www.fact.org/wfc2006/, wfcinfo@fact.org, FACT, Inc., Box 27277, Austin, TX 78755.

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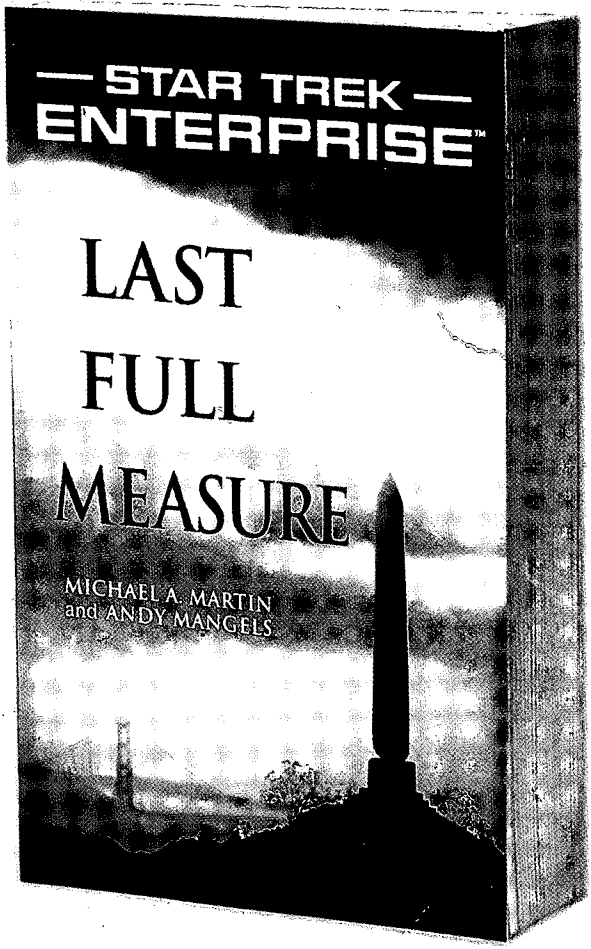
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